USAF SERIES A-37A AIRCRAFT

CONTRACT F33657-67-C-0218

PRELIMINARY FLIGHT MANUAL

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Page No.	Change No.	Issue
*Title	4	15 Feb 68
*A	4	15 Feb 68
*B	4	15 Feb 68
*C Blank	4	15 Feb 68
i thru iii		Original
iv Blank		Original
v		Original
vi Blank		Original
vii	3	1 Jan 68
viii Blank		Original
ix	3	1 Jan 68
x	3	1 Jan 68
1-1 thru 1-3		Original
1-4	3	1 Jan 68
1-5 thru 1-6		Original
1-7	3	1 Jan 68
1-8 thru 1-9		Original
1-10	2	1 Oct 67
1-11 thru 1-14		Original
1-15	3	1 Jan 68
1-16		Original
1-17	3	1 Jan 68
1-18		Original
1-19	2	1 Oct 67
1-20		Original
1-21	2	1 Oct 67
1-22 thru 1-23		Original
1-24 thru 1-25	2	1 Oct 67
1-26 thru 1-28		Original
1-28A	3	1 Jan 68
1-28B Blank	3	1 Jan 68
1-29	3	1 Jan 68
1-30 thru 1-49		Original
1-50	2	1 Oct 67
1-51 thru 1-53		Original
1-54 thru 1-55	2	1 Oct 67
1-56		Original
1-57 thru 1-58	2	1 Oct 67
1-59		Original
1-60 thru 1-61	2	1 Oct 67
1-62 thru 1-63		Original
1-64		Original
2-1	2	1 Oct 67
2-2		Original
2-3	3	1 Jan 68
2-4		Original
2-5	2	1 Oct 67
2-6		Original
2-7	3	1 Jan 68
2-8	2	1 Oct 67
2-9	3	1 Jan 68
2-10		Original
2-11	3	1 Jan 68
2-12	2	1 Oct 67
2-13		Original
2-14	2	1 Oct 67
3-1	2	1 Oct 67
3-2 thru 2-15		Original
3-16 Blank		Original
4-1		Original

CURRENT FLIGHT CREW CHECKLIST

T.O. 1A-37A-1CL-1

1 OCTOBER 1967

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A-4

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USAF ACTIVITIES.— In accordance with T.O. 00-5-2

LIST OF EFFECTIVE PAGES

...table of contents......

DON'T GAMBLE WITH YOUR LIFE

SCOPE

This manual contains the necessary information for safe and efficient operation of the A-37A. These instructions provide you with a general knowledge of the aircraft, its characteristics, and specific normal and emergency operating procedures. Your flying experience is recognized, and therefore, basic flying principles are avoided.

SOUND JUDGEMENT

This manual provides the best possible operating instructions under most circumstances, but it is a poor substitute for sound judgement. Multiple emergencies, adverse weather, terrain, etc., may require modification of the procedures.

PERMISSIBLE OPERATIONS

The flight manual takes a "positive approach" and normally states only what you can do. Unusual operations or configurations (such as asymmetrical loading) are prohibited unless specifically covered herein. Clearance must be obtained from ASD before any questionable operation is attempted which is not specifically permitted in this manual.

HOW TO BE ASSURED OF HAVING LATEST DATA

Refer to T.O. 0-1-1-5A which is issued weekly and devoted solely to listing of all current Flight Manuals, Safety Supplements, Operational Supplements, and Checklists. Its frequency of issue and brevity assures an accurate, up-to-date listing of all these publications.

STANDARDIZATION AND ARRANGEMENT

Standardization assures that the scope and arrangement of all Flight Manuals are identical. The manual is divided into ten fairly independent sections to simplify reading it straight through or using it as a reference manual.

SAFETY SUPPLEMENTS

Information involving safety will be promptly forwarded to you by Safety Supplements. Supplements covering loss of life will get to you in 48 hours by TWX, and those concerning serious damage to equipment within 10 days by mail. The title page of the Flight Manual and the title block of each Safety Supplement should be checked to determine the effect they may have on existing supplements. You must remain constantly aware of the status of all supplements - current supplements must be complied with but there is no point in restricting your operation by complying with a replaced or rescinded supplement.

OPERATIONAL SUPPLEMENTS

Operational Supplements are issued against Flight Manuals as non-safety of flight information so that the using command can achieve or maintain operational posture when new requirements or aircraft changes cannot be timely or adequately covered in the Flight Manual at the time of a scheduled revision or change.

CHECKLISTS

The Flight Manual contains only amplified checklists. Condensed (abbreviated) checklists have been issued as separate technical orders - see the back of the title page for the T.O. number of your latest checklist. Line items in the Flight Manual and checklists are identical with respect to arrangement and item number. Whenever a Safety Supplement affects the condensed (abbreviated) checklist, write in the applicable change on the affected checklist page. As soon as possible, a new checklist page, incorporating the supplement will be issued. This will keep hand-written entries of Safety Supplement information in your checklist to a minimum.

HOW TO GET PERSONAL COPIES

Each flight crewmember is entitled to personal copies of the Flight Manual, Safety Supplements and Checklists. The required quantities should be ordered before you need them to assure their prompt receipt. Check with your supply personnel - it is their job to fulfill your Technical Order requests. Basically, you must order the required quantities on the Publication Requirements Table (T.O. 0-3-1). Technical Orders 00-5-1 and 00-5-2 give detailed information for properly ordering these publications. Make sure a system is established at your base to deliver these publications to the flight crews immediately upon receipt.

FLIGHT MANUAL AND CHECKLIST BINDERS

Loose leaf binders and sectionalized tabs are available for use with your manual. These are obtained through local purchase procedures and are listed in the Federal Supply Schedule (FSC Group 75, Office Supplies, Part 1). Binders are also available for carrying your condensed (abbreviated) checklist. These binders contain plastic envelopes into which

individual checklist pages are inserted. They are available in three capacities and are obtained through normal Air Force supply under the following stock list numbers: 7510-766-4268, -4269, and -4270 for 15, 25, and 40 envelope binders respectively. Check with your supply personnel for assistance in securing these items.

WARNINGS, CAUTIONS, AND NOTES

The following definitions apply to "Warnings," "Cautions," and "notes" found throughout the manual.

WARNING

Operating procedures, techniques, etc., which will result in personal injury or loss of life if not carefully followed.

CAUTION

Operating procedures, techniques, etc., which result in damage to equipment if not carefully followed.

Note

An operating procedure, technique, etc., which is considered essential to emphasize.

YOUR RESPONSIBILITY - TO LET US KNOW

Every effort is made to keep the Flight Manual current. Review conferences with operating personnel and a constant review of accident and flight test reports assure inclusion of the latest data in the manual. However, we cannot correct an error unless we know of its existence. In this regard, it is essential that you do your part. Comments, corrections, and questions regarding this manual or any phase of the Flight Manual program are welcomed. These should be forwarded through your Command Headquarters to Hq ASD, Wright-Patterson AFB, Ohio, Attn: ASZSC, 45433.

CHANGE SYMBOLS

Changes to text and tables in the manual are indicated by a vertical black line in the margin which extends along the entire length of the area affected. Change Symbols are not shown for:

1. Introductory material, indexes and tabular data.
2. Blank spaces which are the result of text, illustration or table deletion.
3. Correction of minor inaccuracies, such as spelling, punctuation, relocation of material, etc., unless such a correction changes the meaning of instructive information and procedures.

SAFETY SUPPLEMENTS SUMMARY

Safety Supplements are numbered with "SS" immediately preceding the -1 contained in the basic publication number and are assigned consecutive dash numbers. Example: T. O. 1A-37A-SS-1-1, -2, -3 etc. The letter "O" is ommitted in the T. O. number to avoid confusion with numerical "zero." Existing Safety Supplements will not be renumbered and will remain effective until rescinded or replaced. The supplements you receive should follow in sequence and if you are missing one, check the Weekly Technical Order Index T. O. 0-1-1-5A to see if it was issued and, if so, is still effective. That supplement may have been replaced or rescinded before you received your copy. If it is still active, see your Publications Distribution Officer and get your copy. It should be noted that a supplement number will never be used more than once. The following portion is to be filled in by you when you receive your Flight Manual, and to be added to as you receive additional supplements. Refer to Technical Order Index T. O. 0-1-5A for latest information if any questions arise.

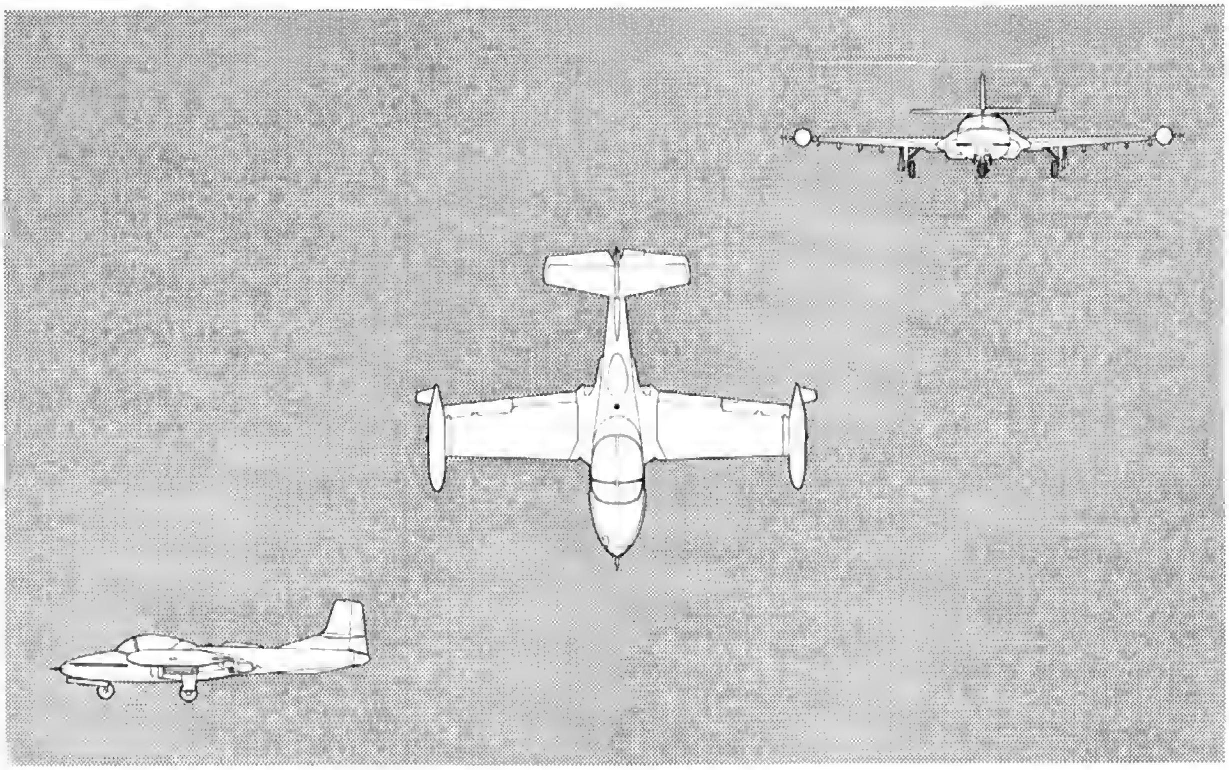
Number	Date	Short Title	Disposition

OPERATIONAL SUPPLEMENTS SUMMARY

Operational Supplements are bordered by black OS's and are assigned consecutive dash numbers. Example: T. O. 1A-37A-1S-1, -2, -3, etc. The letter "O" is omitted in the T. O. number to avoid confusion with numerical "zero." Existing Operational Supplements will not be renumbered and will remain effective until rescinded or replaced. The supplements you receive should follow in sequence and if you find you are missing one, check the Weekly Technical Order Index T. O. 0-1-1-5A to see if it was issued and, if so, is still effective. That supplement may have been replaced or rescinded before you received your copy. If it is still active, see your Publications Distribution Officer and get your copy. It should be noted that a supplement number will never be used more than once. The following portion is to be filled in by you when you receive your Flight Manual, and to be added to as you receive additional supplements. Refer to Technical Order Index T. O. 0-1-1-5A for latest information if any questions arise.

Number	Date	Short Title	Disposition
T. O. 1A-37A-1S-1	15 May 67	External Stores Certification	Replaced by 1S-2
T. O. 1A-37A-1S-2	29 May 67	External Stores Certification	Replaced by 1S-4
T. O. 1A-37A-1S-3	23 Jun 67	Fuel Cells (Foam Baffling)	Incorporated in this change.
T. O. 1A-37A-1S-4	7 Aug 67	External Stores Certification	Incorporated in this change.
T. O. 1A-37A-1S-5	15 Aug 67	Multiple Rocket Launcher Firings	Incorporated in this change.
T. O. 1A-37A-1S-6	20 Sept 67	Oxygen Duration Reduction	Incorporated in this change.

A-37A



SECTION I

DESCRIPTION AND OPERATION

TABLE OF CONTENTS

THE AIRCRAFT

The A-37A is a low wing dual control jet attack, counterinsurgency aircraft, of all metal construction and side by side seating, manufactured by Cessna Aircraft Company. Power for the aircraft is provided by two General Electric turbojet engines. The aircraft is equipped with a two position speed brake, spoilers for artificial stall warning, thrust attenuators to provide a satisfactory approach angle for landing, a jettisonable clamshell canopy and ejection seats. Conventional tricycle landing gear is utilized for takeoff and landing. Other noteworthy features include 95 U. S. gallon fuel tanks at each wing tip, 4 armament pylons under each wing (Air Force MA4-A bomb racks) which will accommodate drop tanks, bombs, rockets, and armament pods. The aircraft contains an air conditioning and defrosting system, oxygen equipment, provisions for a nose mounted 7. 62 mm minigun, and full instrumentation and lighting for day or night flying. The aircraft is designed for utility, ruggedness, and safety.

DIMENSIONS

The overall dimensions of the aircraft under normal conditions of gross weight, tire and gear inflation are as follows:

Wing Span with Tip Tanks	38. 21 ft.
Length	29. 28 ft.
Height	9. 47 ft.
Wheel Base	7. 83 ft.
Wheel Tread	13. 66 ft.

Refer to Section II for minimum turning radius and ground clearances.

TYPICAL WEIGHTS

The weight of the aircraft with trapped fuel and oil, pylons, one pilot and the nose gun or nose gun ballast is 5996 pounds. The design gross weight is 12, 000 pounds. Refer to Section V for additional information.

ENGINES

Thrust is supplied by two General Electric J85-17A engines. Approximate standard sea level maximum thrust rating for the engines is 2400 pounds each. The J85-17A engine is an axial flow turbojet engine. Air enters through the variable inlet guide vanes, which direct the flow of air into the compressor, an eight-stage axial flow compressor, driven by a two stage turbine on a common rotor shaft. The automatic positioning of the inlet guide vanes and bleed air valves assists in regulating compressor airflow to maintain compressor stall free operation. Air drawn into the inducer and compressor rotors, is compressed and forced into the combustion chamber where it is mixed with injected fuel and burned. The hot gases are directed upon the turbine rotor which speeds up the compressor-turbine shaft to draw in and compress additional air. The hot gases of combustion pass through the exhaust diffuser and expand in the aircraft's tailpipe to produce thrust. The engines accessory section, driven by the compressor-turbine shaft, provides reduction gearing and mounting pads for all engine-driven accessories.

ENGINE FUEL CONTROL SYSTEM

Fuel flow requirements are established by the pilot's or copilot's throttle movements, and fuel flow to the engine is delivered and regulated by the engine fuel

GENERAL

1. RIGHT WING TIP TANK
2. EJECTION SEATS
3. FUSELAGE FUEL TANK
4. HYDRAULIC RESERVOIR
5. MAGNETIC DETECTOR
6. RUDDER TRIM TAB ACTUATOR
7. ELEVATOR TRIM TAB ACTUATOR
8. OXYGEN CYLINDERS
9. LEFT THRUST ATTENUATOR
10. RADIO EQUIPMENT
11. OIL FILLER AND TANK
12. LEFT LANDING LIGHT
13. AILERON TRIM TAB ACTUATOR
14. LEFT WING TIP TANK
15. LEFT WING TIP TANK FILLER CAP
16. LEFT WING TANK FILLER CAP

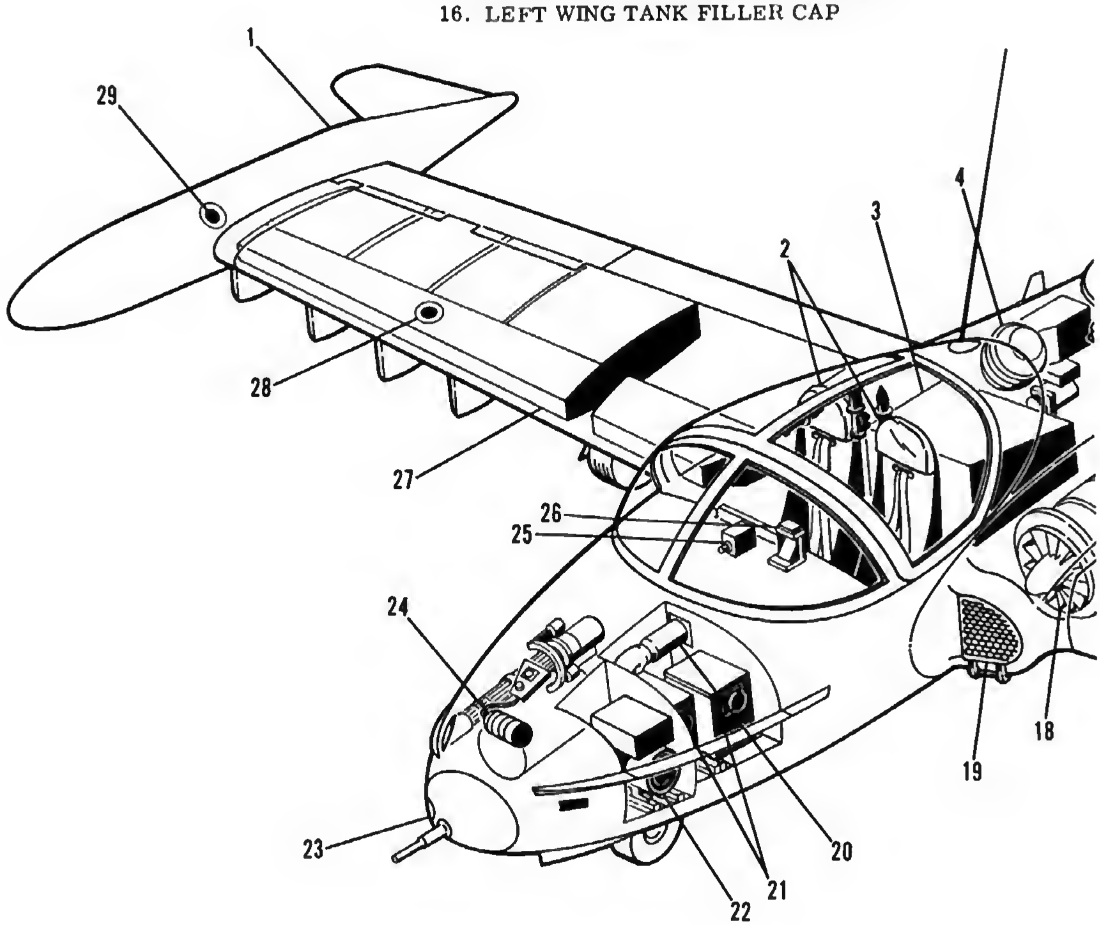
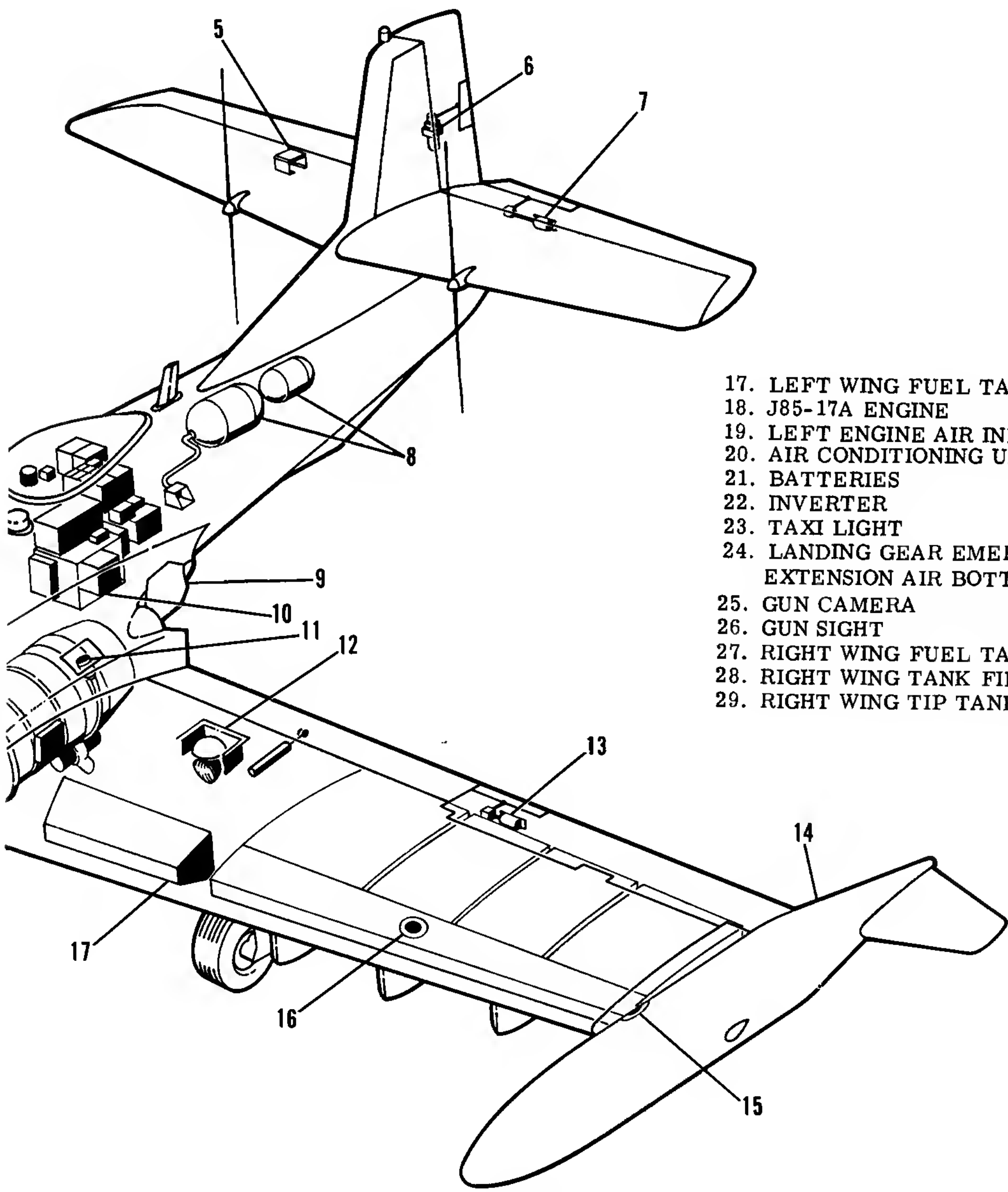


Figure 1-1 (Sheet 1 of 2)

ARRANGEMENT



17. LEFT WING FUEL TANK
18. J85-17A ENGINE
19. LEFT ENGINE AIR INLET SCREEN
20. AIR CONDITIONING UNIT
21. BATTERIES
22. INVERTER
23. TAXI LIGHT
24. LANDING GEAR EMERGENCY EXTENSION AIR BOTTLE
25. GUN CAMERA
26. GUN SIGHT
27. RIGHT WING FUEL TANK
28. RIGHT WING TANK FILLER CAP
29. RIGHT WING TIP TANK FILLER CAP

Figure 1-1 (Sheet 2 of 2)

control system (figure 1-8). The fuel control system is designed to provide the engine with the proper amount of fuel for operation in all attitudes of flight within the flight envelope. Changes in engine speed, ambient temperatures (T-2), and pressure, compressor discharge pressure, and engine throttle position are compensated for automatically. Fuel is not only used for combustion but also for automatic operation of the engine variable geometry, to lubricate and operate servos in the main fuel control and overspeed governor, and as a coolant for engine lube oil. The major components of the main fuel system include the main fuel pump, the main fuel control, the overspeed governor, the oil cooler, the fuel pressurizing valve, two fuel manifolds, twelve flow divider-fuel nozzles, the manifold drain valve and two hydraulic variable geometry actuators.

THROTTLES

Four throttles (1, 2, 9, 10, figure 1-6) are provided, two on each quadrant. Each quadrant is marked CUT-OFF, IDLE, and 100%. The two sets of throttles are mechanically interconnected. Throttle movement, through the use of teleflex cables, mechanically actuates each engine fuel control unit. Lift type idle detents are included on the copilot's quadrant to prevent inadvertent positioning of either set of throttles from the IDLE to CUT-OFF position. The idle detents affect both sets of throttles. It is necessary to lift the copilot's throttles past the idle detent if engine shutdown is to be made. It is advisable to use copilot's throttles for all engine starts in order to have cut-off feature available.

Throttle Friction Knob

A throttle friction knob (6, figure 1-6) provides a means of increasing throttle friction. The friction knob can be overcome and will not prevent either crew member from manually positioning the throttles to a new setting.

INLET SCREENS

The screen extend light on the annunciator panel will illuminate when the screens are in place over the engine inlets. Retractable engine inlet screens are over both engine inlets. The screens, when retracted, are stowed under the lower front edge of the nacelles. When extended, the screens will rotate around the lower tips of the inlet and cover the inlet. The inlet screens are hydraulically actuated and electrically controlled. The screens prevent injestion of foreign objects on the ground and in flight.

WARNING

The maximum screen cycle speed is 300 KIAS.

Inlet Screens Switch

The screens are controlled by a three-position, EXTEND, RETRACT and AUTO, switch (5, figure 1-7). In the AUTO position, the screen is in place when the aircraft is on the ground and the throttle settings are below 90% rpm. The screen automatically retracts, on takeoff, when the throttles are advanced above 90% rpm. In the manually selected EXTEND or RETRACT position, the screen will remain in the position indicated at all air speeds. Power for the warning light and the inlet screens switch is supplied by the 28 volt dc bus.

ENGINE ICE WARNING SYSTEM

The engine ice warning system, warns the pilot of icing in the engine air inlet ducts. The engine ice warning light on the annunciator panel (6, figure 1-13), is amber in color and is illuminated once ice has formed on the ice detect probe which is located in the left engine air inlet duct. Power for the warning light and ice detect probe is received from the 28 volt dc bus.

Note

Retarding the throttles rapidly will cause the engine ice warning light to occasionally illuminate, due to negative pressure in the ice detect probe.

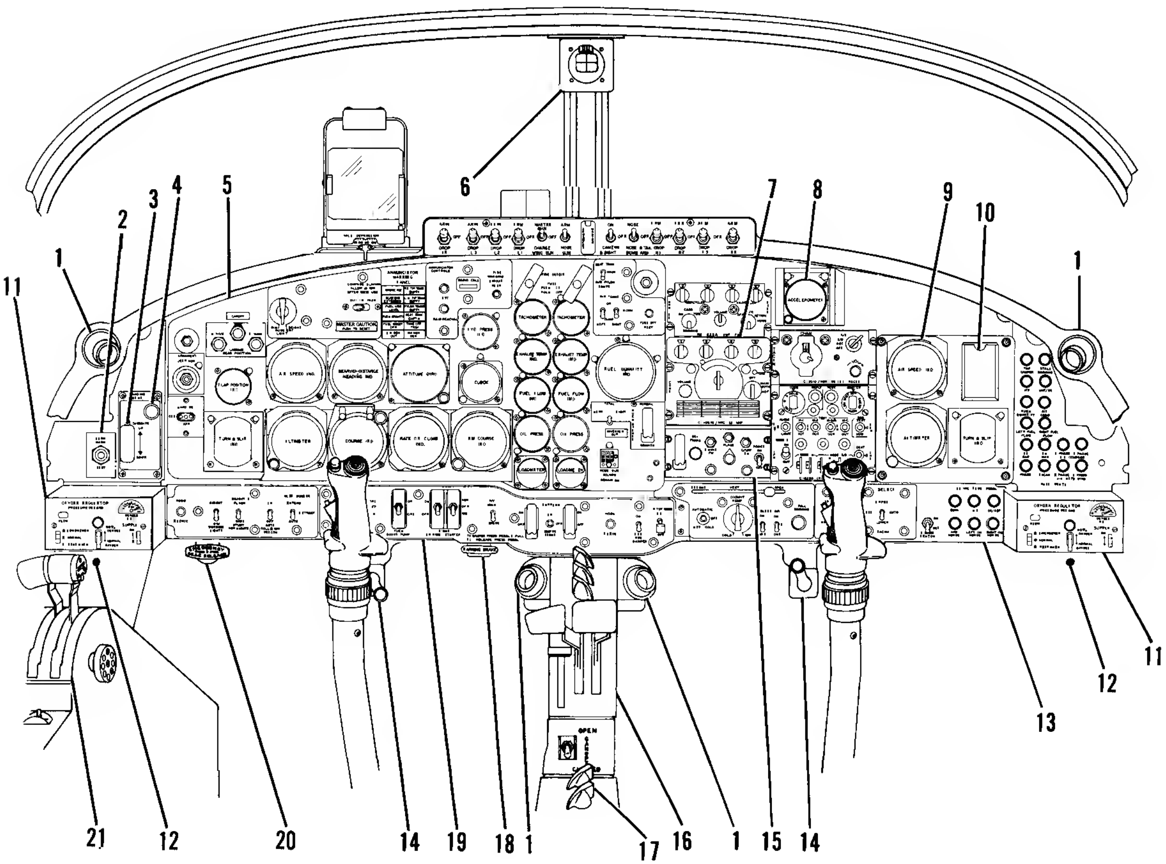
IGNITION SYSTEM

An ignition system operating on 28 volt dc current from the bus, is provided for each engine. Each ignition system comprises an ignition coil, two fuel ignitors, and a two position channel guarded ignition switch. Ignition is used for all ground starting, but is not used to sustain combustion once the engine has started.

Ignition Switches

The ignition switches (6 and 9, figure 1-7) regulate ignition and starting fuel to the engines. The switches are channel guarded and are marked Ignition and have positions ON and OFF. The switches are spring-loaded to the OFF position. Positioning an ignition switch to ON, with the respective starter switch in the GND position, allows current to energize a starting fuel solenoid valve and the ignition coil for its respective engine. Once the engine has sustained combustion, the ignition switch should be released and allowed to return to the OFF position.

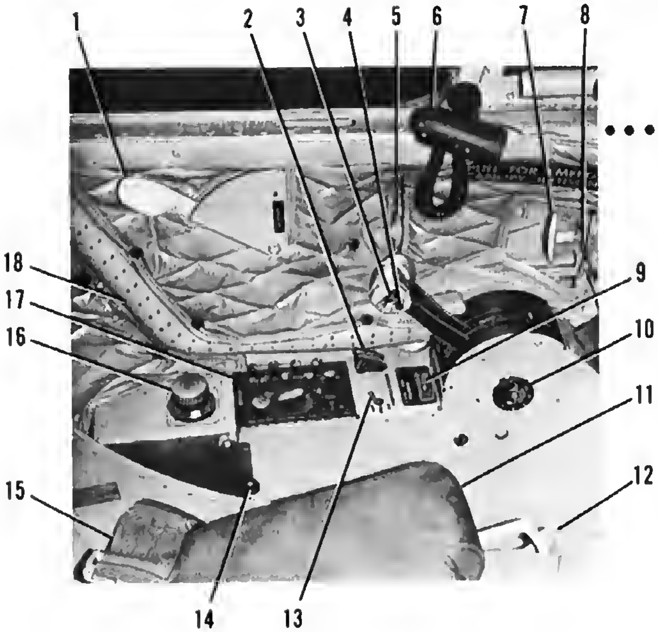
COCKPIT FORWARD VIEW



1. AIR OUTLET
2. LANDING GEAR WARNING LIGHT TEST SWITCH
3. LANDING GEAR LEVER
4. LANDING GEAR EMERGENCY OVERRIDE SWITCH
5. LEFT INSTRUMENT PANEL
6. MAGNETIC COMPASS
7. UHF COMMAND RADIO
8. ACCELEROMETER
9. RIGHT INSTRUMENT AND CIRCUIT BREAKER PANEL
10. MAGNETIC COMPASS CORRECTION CARD
11. OXYGEN REGULATOR
12. AIR CONTROL KNOB
13. AC FUZE PANEL
14. RUDDER PEDAL ADJUSTMENT CRANK
15. KY-28 SECURE VOICE
16. COPILOTS QUADRANT
17. RADIO LIGHTS RHEOSTAT
18. PARKING BRAKE HANDLE
19. SWITCH PANEL
20. LANDING GEAR EMERGENCY "T" HANDLE
21. PILOTS QUADRANT

Figure 1-2

COCKPIT

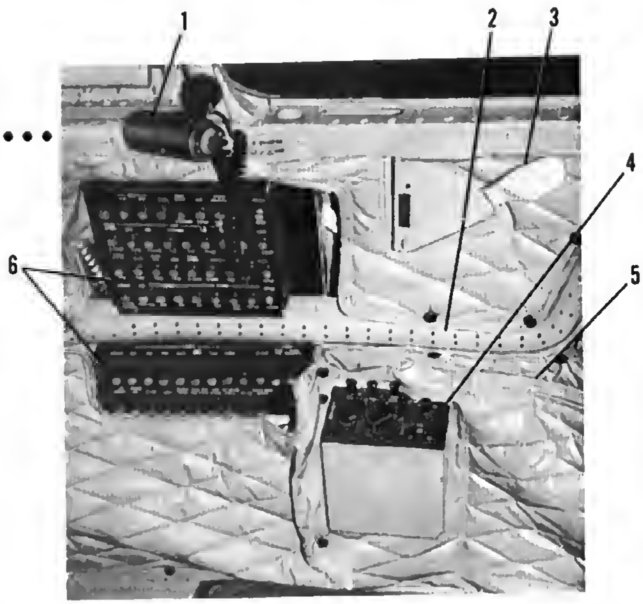


Left Side

1. CANOPY DOWNLOCK HANDLE
2. GROUND ARM SWITCH
3. SPEED BRAKE SWITCH
4. MICROPHONE BUTTON
5. CANOPY DE-CLUTCH HANDLE
6. COCKPIT LIGHT
7. CANOPY JETTISON "T" HANDLE
8. "T" HANDLE SAFETY PIN
9. RUDDER TRIM TAB SWITCH
10. THROTTLE FRICTION KNOB
11. PILOT'S SEAT
12. ARMING HANDLE GUARD
13. STRIKE CAMERA POWER SWITCH
14. SHOULDER HARNESS LOCKING LEVER
15. SAFETY BELT
16. STRIKE CAMERA INTERVALOMETER
17. INTERPHONE CONTROL PANEL
18. PICCOLO TUBE

Figure 1-3

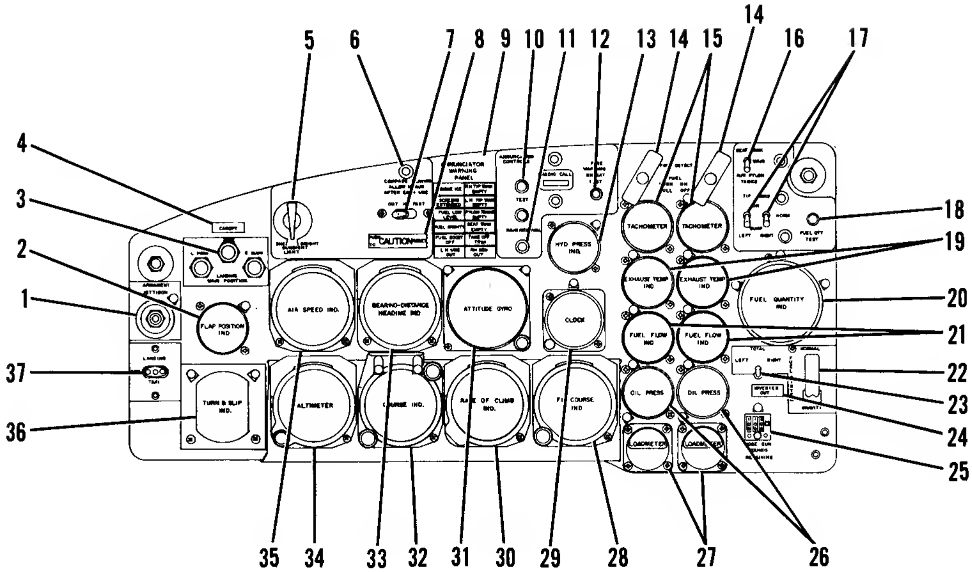
Right Side



1. COCKPIT LIGHT
2. PICCOLO TUBE
3. CANOPY DOWNLOCK HANDLE
4. INTERPHONE CONTROL PANEL
5. MAP AND DATA CASE
6. CIRCUIT BREAKER PANELS

Figure 1-4

Left Instrument Panel



1. ARMAMENT JETTISON BUTTON
2. WING FLAP POSITION INDICATOR
3. LANDING GEAR POSITION INDICATOR LIGHTS
4. CANOPY NOT LOCKED WARNING LIGHT
5. GUNSIGHT LIGHT CONTROL SWITCH
6. POST LIGHT
7. J-2 COMPASS SLAVE SWITCH
8. MASTER CAUTION LIGHT
9. ANNUNCIATOR WARNING PANEL
10. ANNUNCIATOR PANEL TEST SWITCH
11. RAIN REMOVAL SWITCH
12. FIRE WARNING CIRCUIT TEST SWITCH
13. HYDRAULIC PRESSURE GAGE
14. FUEL SHUTOFF "T" HANDLES
15. TACHOMETERS
16. FUEL SELECT SWITCH
17. TIP TANK SWITCHES
18. FUEL QUANTITY TEST SWITCH
19. EXHAUST GAS TEMPERATURE GAGES
20. FUEL QUANTITY GAGE
21. FUEL FLOW GAGES
22. FUEL SYSTEM SWITCH
23. FUEL GAGING SELECTOR SWITCH
24. INVERTER OUT WARNING LIGHT
25. NOSE GUN ROUNDS REMAINING COUNTER
26. OIL PRESSURE GAGES
27. LOADMETERS
28. FM HOMING INDICATOR
29. CLOCK
30. VERTICAL VELOCITY INDICATOR
31. J-8 ATTITUDE INDICATOR
32. COURSE INDICATOR
33. BEARING-DISTANCE-HEADING INDICATOR
34. ALTIMETER
35. AIRSPEED INDICATOR
36. TURN AND SLIP INDICATOR
37. LANDING-TAXI LIGHT SWITCH

Figure 1-5

CONTROL QUADRANTS

1. RIGHT ENGINE THROTTLE
2. LEFT ENGINE THROTTLE
3. MICROPHONE SWITCH
4. WING FLAP LEVER
5. PILOT'S QUADRANT
6. THROTTLES FRICTION KNOB
7. RUDDER TRIM SWITCH
8. SPEED BRAKE SWITCH
9. LEFT ENGINE THROTTLE
10. RIGHT ENGINE THROTTLE
11. SPEED BRAKE SWITCH
12. CANOPY SWITCH
13. PRIMARY FLIGHT INSTRUMENT LIGHT RHEOSTAT
14. PRIMARY INSTRUMENT LIGHT RHEOSTAT
15. SECONDARY INSTRUMENT LIGHT RHEOSTAT
16. COPILOT'S QUADRANT
17. WING FLAP LEVER
18. MICROPHONE SWITCH

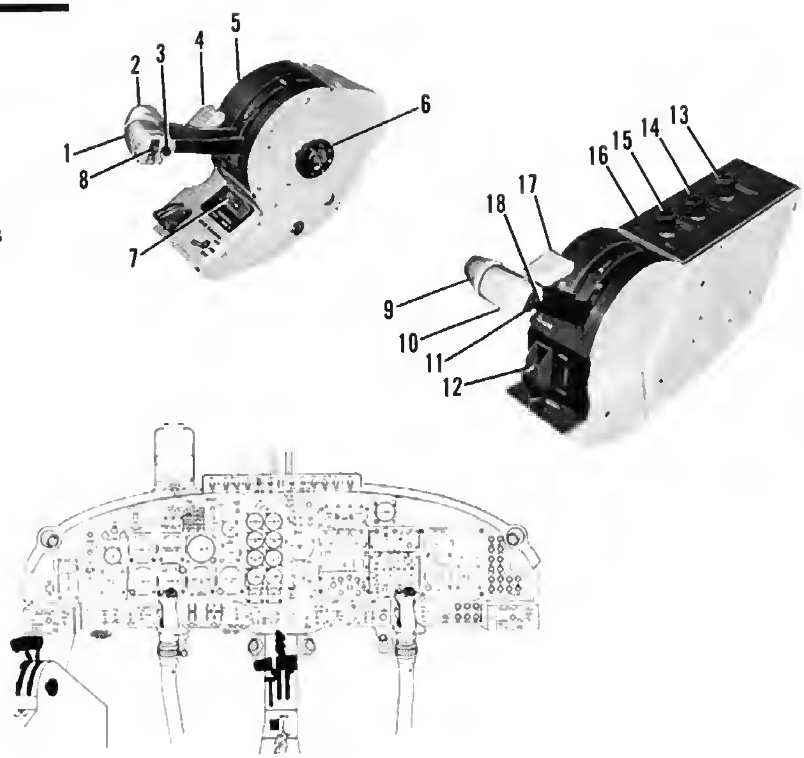


Figure 1-6

STARTING SYSTEM

A starting system, operating on 28 volt dc current from the bus is provided for each engine. Each starting system consists of a starter switch and a combination starter-generator located on the lower portion of the engine. An external power source is not required for starting the engine.

Starter Switches

The starter switches (7, 10, figure 1-7) are marked Starter, with positions GND, OFF, and AIR. The switches are channel guarded and are spring-loaded to the OFF position. The GND position permits power from the main bus to energize the starter. When the starter switch is positioned to the AIR position and released, a time delay relay is actuated which provides ignition and starter for approximately 30 to 45 seconds to effect an air or ground start.

ENGINE INSTRUMENTS

Tachometers

The tachometers (15, figure 1-5) are self-generating instruments that indicate engine speed in percentage of the rated rpm. They operate independently of the aircraft electrical system except for instrument lighting. On this aircraft the rated rpm is 16, 500 rpm. Used in conjunction with the exhaust gas temperature indicator, this instrument enables engine power to be set without exceeding the engine limitations.

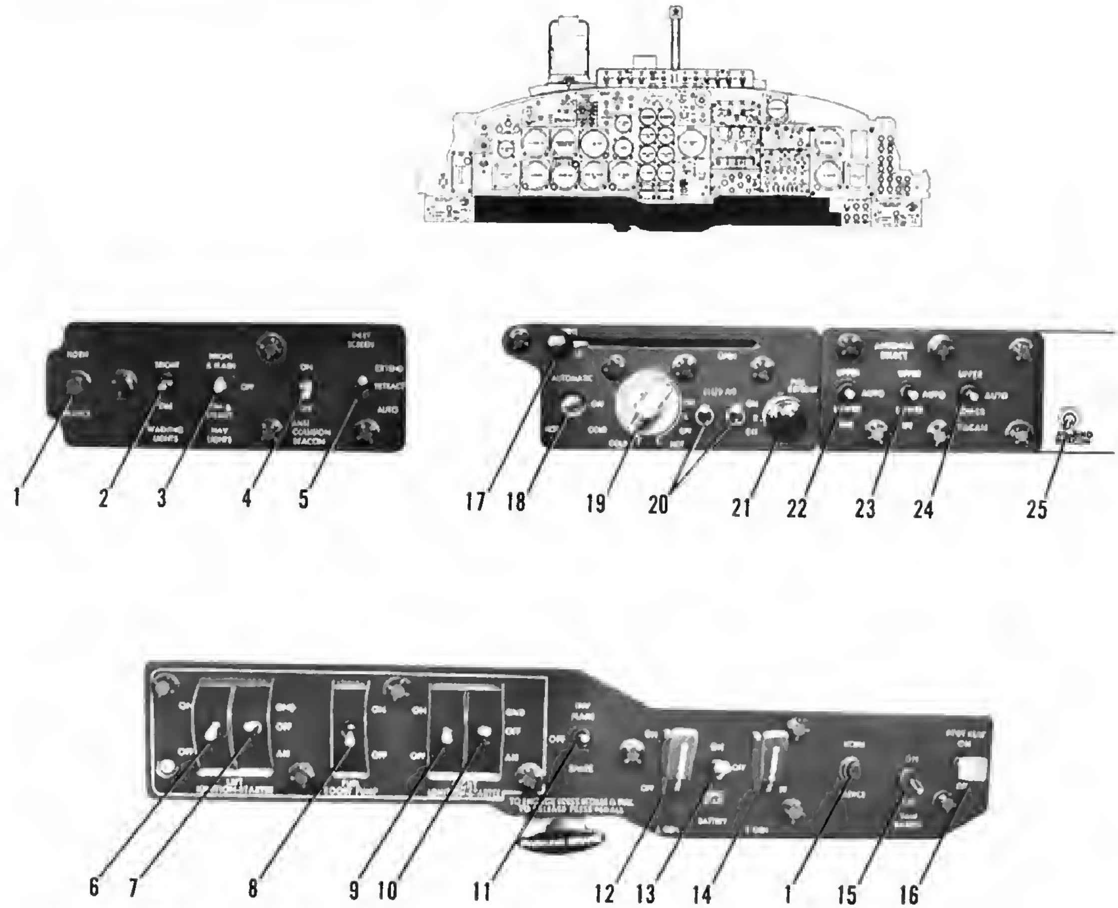
Exhaust Gas Temperature Indicators

The exhaust gas temperature indicators (19, figure 1-5), are self-generating instruments that indicate temperature in degrees centigrade. Electrical current for the exhaust gas temperature indicators is supplied by six thermocouples located in the tailpipe of each engine.

Fuel Flow Indicators

Fuel flow, in pounds per hour to each engine, is indicated by the fuel flow indicators (21, figure 1-5). The fuel flow indicators are powered from the 28 volt single phase ac bus.

Switch Panel



1. GEAR AUDIBLE SILENCING SWITCH
2. WARNING LIGHTS DIM SWITCH
3. NAVIGATION LIGHTS SWITCH
4. ANTI-COLLISION BEACON SWITCH
5. INLET SCREEN SWITCH
6. LEFT IGNITION SWITCH
7. LEFT STARTER SWITCH
8. FUEL BOOST PUMP SWITCH
9. RIGHT IGNITION SWITCH
10. RIGHT STARTER SWITCH
11. MAIN-SPARE INVERTER SWITCH
12. LEFT GENERATOR SWITCH
13. BATTERY SWITCH
14. RIGHT GENERATOR SWITCH
15. YAW DAMPER SWITCH
16. PITOT HEAT SWITCH
17. COCKPIT AIR LEVER
18. AIR TEMPERATURE CONTROL SWITCH
19. AIR TEMPERATURE CONTROL RHEOSTAT
20. BLEED AIR SWITCHES
21. DEFROST CONTROL KNOB
22. UHF ANTENNA SELECT SWITCH
23. IFF ANTENNA SELECT SWITCH
24. TACAN ANTENNA SELECT SWITCH
25. X-BAND BEACON SWITCH

Figure 1-7

Oil Pressure Indicators

The oil pressure indicators (26, figure 1-5) are remote indicating instruments and are operated by the 28 volt single phase ac bus. The indicators indicate oil pressure in pounds per square inch.

OIL SUPPLY SYSTEM

The engine has a pressurized, closed-circuit lubrication system designed to furnish oil to parts requiring lubrication during engine operation. After oil has been supplied to these parts, it drains to the sumps from which it is recovered by the scavenge elements of the lube pump and recirculated to the oil reservoir. All system components are engine furnished and engine mounted. External oil lines are kept at a minimum by the use of internal lines and, cored or drilled passages. The main components of the lube system are a lube and scavenge pump, an oil reservoir, an oil cooler and an oil filter mounted in the lube and scavenge pump. The oil pump does not have an inverted flight scavenge element.

Each engine has an independent oil system, and is a completely automatic system requiring no control action by the pilot. The capacity of each oil system is 4.5 quarts of oil, of this amount 4 is usable oil. See figure 1-48 for oil specification.

FUEL SUPPLY SYSTEM

Three self-sealing tanks are installed in the aircraft: one in the fuselage and one in each wing. All fuel tanks including drop tanks are filled with a foam material to reduce fuel slosh to a minimum. Six interconnected fuel cells make one wing fuel tank. (See figure 1-9.) Two 95 U.S. gallon tip tanks are installed on each wing tip. These are dumpable, non-self-sealing fuel tanks. Provisions for four drop tanks, installed on the pylon stations (inboard and inboard intermediate) are provided for additional fuel, and are drawn from, equally by the fuel proportioners, into the fuselage tank. Provisions for a right-hand seat fuel tank are provided when the ejection seat, seat rails, control stick, and rudder pedals are removed. The tank is self-sealing and fuel is transferred to the fuselage tank by an electrical transfer pump. Fuel is supplied to the engines from the fuselage tank by an electrical fuel boost pump. In normal operation, fuel is transferred, under pressure, from the wing tanks to the fuselage tank in equal quantity by two electrical proportioner pumps. The proportioner pumps operate automatically when the fuel quantity in the fuselage tank drops below a preset level. In emergency operation, fuel is supplied to the fuselage tank from the wing tanks by gravity feed. The aircraft is refueled by means of four filler points, located in the outboard leading edge of each wing, and tip tank. Refer to figure 1-48 for fuel specification.

WARNING

Use of outboard pylons limited to tip tanks empty operations only.

CAUTION

The aircraft status is changed to a red diagonal in the AF Form 781 if it becomes necessary to remove the foam from any fuel tank, except drop tanks. Drop tanks should normally contain foam, but it is not mandatory to change the aircraft status if foam is not available for drop tanks. If such a red diagonal must be signed off for flight without foam, pilots must exercise additional caution - especially while tip tank fuel remains. Slosh and vibration effects will be marked and will greatly increase fatigue, particularly in tip tank mounting rings.

Note

Fuel system is limited to 10 seconds inverted flight.

FUEL BOOST PUMP

A centrifugal pump is located inside the inverted flight chamber in the bottom of the fuselage tank. It supplies fuel under low, positive pressure to both engines. The pressure helps prevent high altitude engine surge. It also provides fuel to reprime the engine-driven fuel pump in the event of cavitation (air lock).

Fuel Boost Pump Switch

The fuel boost pump switch (8, figure 1-7) has ON and OFF positions. The switch is always in the ON position for normal flight conditions. Power for the switch is supplied by the 28 volt dc bus.

Fuel Boost Pump Warning Light

An amber fuel boost pump warning light on the annunciator panel (2, figure 1-13) provides the pilot with an indication that the fuel boost pump is not providing normal fuel pressure. The light, operated through the action of a pressure switch located in the fuel line, receives its electrical power from the 28 volt dc bus.

Note

The fuel boost pump warning light may flicker momentarily near zero G conditions due to a momentary lack of fuel at the boost pump inlet.

FUEL SHUTOFF T HANDLES

A fuel shutoff T handle (14, figure 1-5) for each engine is located on the top of the instrument panel. In the PUSH-ON position, a circuit to the morotized fuel shutoff valve is completed which permits 28 volt dc power to open the valves and lets fuel flow from the fuel boost pump to the engine fuel control. When the T handle is in the PULL-OFF position the motorized fuel shutoff valve is energized closed. For all normal operating conditions the fuel shutoff T handle should be in the PUSH-ON position. Only in an emergency condition should the PULL-OFF position be used. Each T handle also contains a 28 volt dc red light which is illuminated when a fire condition exists in a respective engine nacelle.

ENGINE FUEL CONTROL SYSTEM

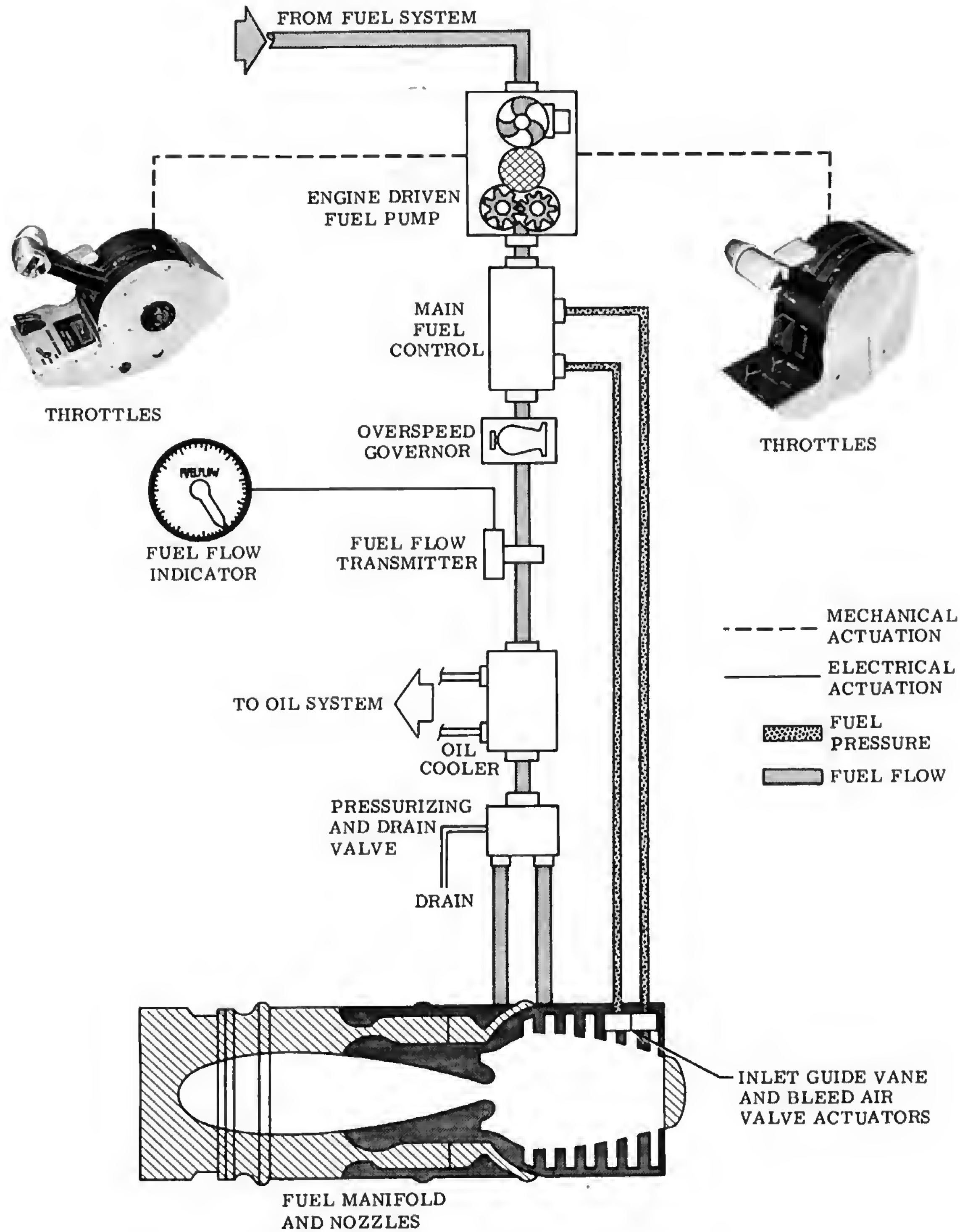


Figure 1-8

AIRCRAFT FUEL SYSTEM

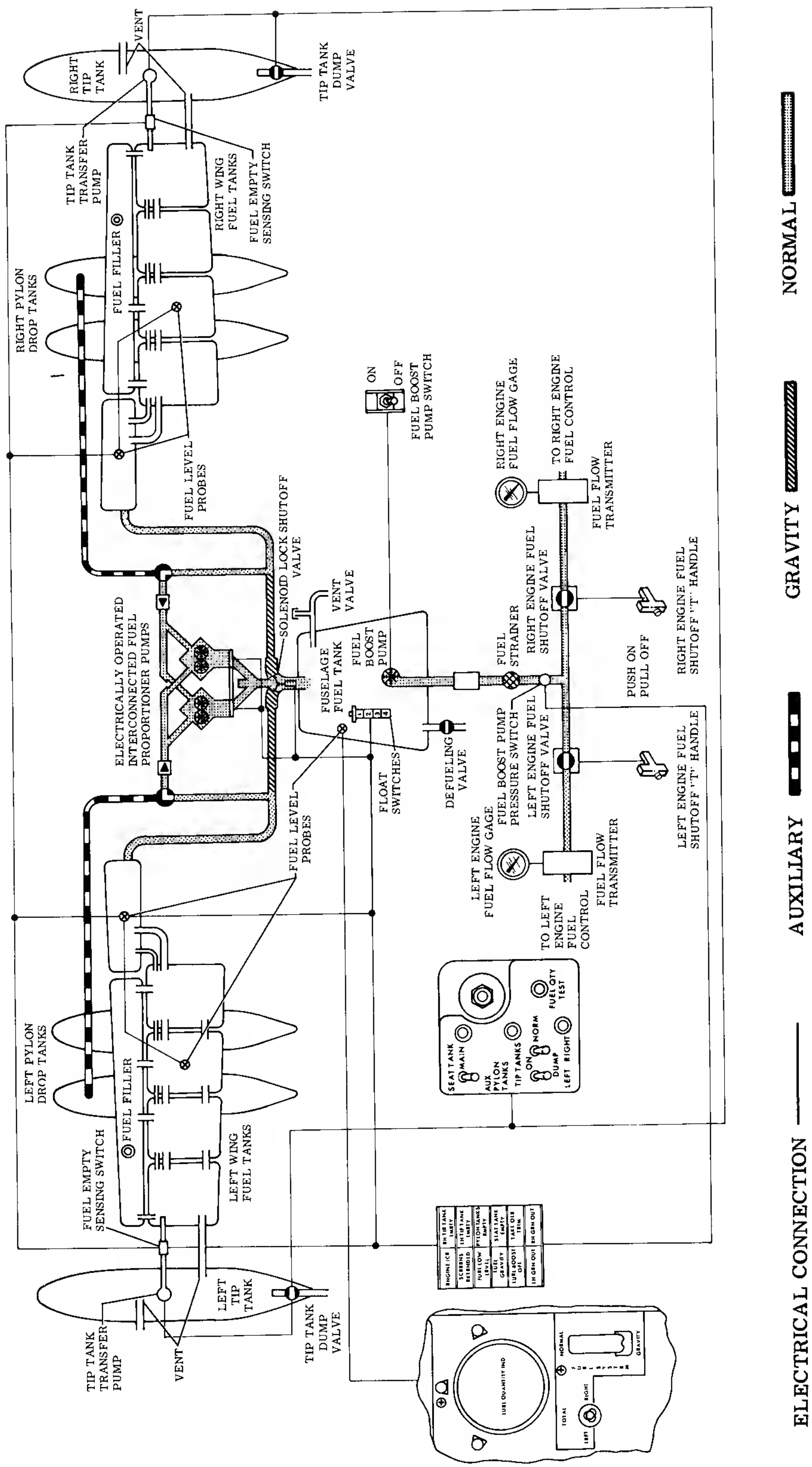


Figure 1-9

CAUTION

The fuel shutoff "T" handles are electrical switches and movement is restricted to a very short travel. It takes up to 10 seconds for an engine to stop running after a fuel shutoff "T" handle has been positioned to the PULL-OFF position.

FUEL QUANTITY INDICATOR

A fuel quantity indicator (20, figure 1-5) indicates the quantity, in pounds, of total internal usable fuel remaining. The fuel quantity indicator receives its power from the single phase 115 volt ac bus.

Note

Total external fuel, tip and drop tanks, is not included on the fuel quantity indicator.

FUEL GAGING SELECTOR SWITCH

The fuel gaging selector switch (23, figure 1-5) has three positions; LEFT, TOTAL (internal), and RIGHT. The switch uses power from the 28 volt dc bus to complete a circuit between the fuel quantity indicator and the fuel cell probes. The switch in the TOTAL position, indicates total internal fuel aboard. Fuel remaining in the left or right wing tank can be gaged by placing the switch in the LEFT or RIGHT positions, respectively, until the reading on the fuel quantity indicator stabilizes.

Fuel Quantity Indicator Test Switch

The fuel quantity indicator test switch (18, figure 1-5) uses power from the 115 volt ac bus during the operational check of the fuel quantity indicator. Pushing in on the fuel quantity test switch returns the fuel quantity indicator needle to zero, indicating that the fuel gaging system is operating.

FUEL SYSTEM SWITCH

The fuel system switch (22, figure 1-5) provides both normal and gravity operation of the fuel system. The switch has two positions, NORMAL, and GRAVITY, with the switch guarded to the NORMAL position. The switch in the NORMAL position energizes the solenoid lock fuel shutoff valve to the closed position and alerts the fuel proportioner circuit. With the switch in the GRAVITY position, the fuel proportioner pump circuit and the solenoid lock shutoff valve are de-energized. This allows the solenoid locked shutoff valve to open and the amber gravity feed light on the annunciator panel (3, figure 1-13) to illuminate, indicating that the fuel system is operating in the gravity feed system. The fuel system receives its power from the 28 volt dc bus.

TIP TANK TRANSFER PUMP AND DUMP SWITCHES

The tip tank pump and dump switches (17, figure 1-5), one for each tank, are located on the fuel panel. Each switch has three positions, ON, NORM, and DUMP. With either or both switches in the ON position, inverter power is provided to the transfer pumps to transfer fuel from the tip tanks to the wing tanks. Tip tank fuel will circulate from the wing tank back through the vent tube to the tip tank until the fuel level in the wing tank is lower than the vent opening, for this reason tip tank fuel should not be selected until it is desirable to transfer it. In the NORM position, the pumps are inoperative. In the DUMP position, the motor-driven gate valves are actuated to the open position and the tanks dump their fuel. To stop dumping fuel, the switches must be positioned to the ON position for approximately 2 seconds, then positioned to NORM.

TIP TANK EMPTY LIGHT

An amber tip tank fuel transfer pump warning light (7-8, figure 1-13), one for each pump, is located on the annunciator panel. These lights provide an indication that the pumps are transferring fuel. When the tip tank pump and fuel dump switches are actuated to the ON position, the warning lights will momentarily illuminate until pressure is built up. When pressure is built up the lights will go out and stay out as long as fuel is being transferred to the wing tanks. The lights will again illuminate when the tanks are empty. When the tanks are empty the switches should be positioned to NORM and the lights will go out.

SEAT TANK AND AUXILIARY PYLON TANKS SWITCH

The seat tank and auxiliary pylon tanks switch is located on the fuel panel above the tip tank switches. This switch has three positions, SEAT TANK, MAIN, and AUX PYLON TANKS. When the switch is in the SEAT TANK position, fuel is transferred from the seat tanks to the fuselage tank by a transfer pump. To stop the transferring of fuel the switch must be positioned to MAIN. With the switch in the AUX PYLON TANKS position, fuel is drawn from the drop tanks by the fuel proportioner pumps to the fuselage tank. To stop the transferring of fuel the switch must be positioned to MAIN. In the MAIN position fuel will be transferred from the wing tanks to the fuselage tank. The tip tank fuel will only transfer when the switch is in the MAIN position, and tip tank switches are ON. Wing fuel level will then become lower than tip fuel level to allow transfer.

Note

- When using seat tank fuel or auxiliary pylon fuel, the tip tank switches should be placed in the NORM position to prevent the tip tank pumps from running and circulating wing and tip fuel.
- Seat tank fuel cannot be jettisoned or dumped.

FUEL QUANTITY DATA

TOTAL USABLE FUEL IN U. S. GALLONS AND POUNDS		
WITHOUT DROP TANKS	GALLONS 457.5	POUNDS 2973.7
WITH TWO 100 GALLON DROP TANKS	GALLONS 657.5	POUNDS 4273.8
WITH FOUR 100 GALLON DROP TANKS	GALLONS 857.5	POUNDS 5573.8

TANKS	USABLE FUEL IN LEVEL FLIGHT	
FUSELAGE	79 GALLONS	513.5 POUNDS
WINGS 99.25 GAL. EACH	198.5 GALLONS	1290.0 POUNDS
TIP TANKS 95 GAL. EACH	180 GALLONS	1170.0 POUNDS
DROP TANKS 100 GAL. EACH	(TWO) 200.0 GALLONS (FOUR) 400.0 GALLONS	1300.0 POUNDS 2600.0 POUNDS

NOTE: POUNDS SHOWN ARE APPROXIMATE FOR STANDARD DAY CONDITIONS ONLY AND ARE BASED ON 6.5 POUNDS PER GALLON OF JP-4 FUEL.

Figure 1-10

PYLON TANKS EMPTY WARNING LIGHT

An amber pylon tank fuel warning light is located on the annunciator panel (9, figure 1-13). When the seat tank and auxiliary pylon tank switch is actuated to the AUX PYLON TANKS position the warning light will stay out as long as fuel is being transferred to the fuselage tank. The light will illuminate when the tanks are empty, and operates through the action of a fuel float switch located in the fuselage tank and receives its power from the 28 volt dc bus. When the tanks are empty the switch should be positioned to MAIN and the light will go out.

SEAT TANK EMPTY WARNING LIGHT

An amber seat tank empty light is located on the annunciator panel, (10, figure 1-13). The light will illuminate when the tank is empty, and operates through the action of a fuel float switch located in the fuselage tank and receives its power from the 28 volt dc bus. The seat tank and auxiliary pylon tanks transfer switch should be positioned in the MAIN position and the light will go out.

FUEL LOW LEVEL WARNING LIGHT

The fuel low level warning light on the annunciator panel (4, figure 1-13) will illuminate when fuel in the fuselage tank reaches a level of approximately 305 ±25 pounds. This light, operates through the action of a fuel low level float switch located in the fuselage tank and receives its power from the 28 volt dc bus.

FUEL GRAVITY LIGHT

An amber light on the annunciator panel (3, figure 1-13) provides the pilot with an indication that the fuel system is on gravity feed. The gravity feed light is powered by the 28 volt dc bus through the operation of the solenoid lock fuel shutoff valve and the fuselage fuel tank float switches.

FUEL STRAINER DRAIN VALVE

A fuel strainer drain valve is located in the fuel strainer, at the low point of the system. The fuel strainer drain valve is a self-closing valve and is used to drain condensation and sediment from the fuel strainer. It can be reached through an access door located left of the forward tunnel access door, and is not accessible in flight.

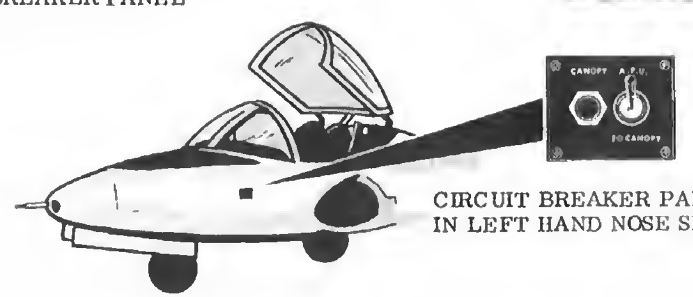
Right Instrument Panel

CIRCUIT BREAKER PANEL and AC FUSE PANEL

ARMAMENT CIRCUIT
BREAKER PANEL

AC FUSE PANELS

UPPER AND LOWER
CIRCUIT BREAKER
PANELS



CIRCUIT BREAKER PANEL
IN LEFT HAND NOSE SECTION

Figure 1-11

Electrical Power

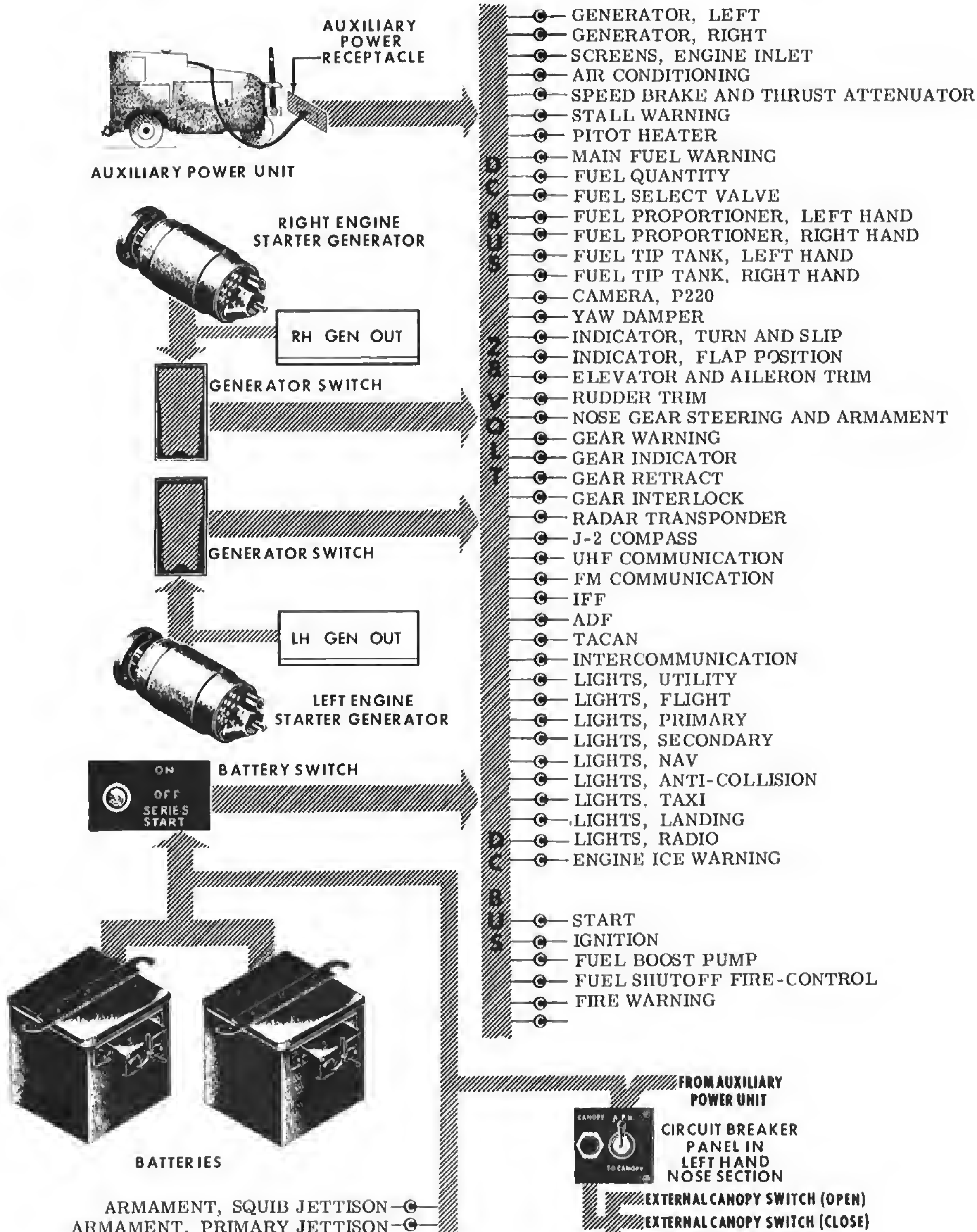


Figure 1-12 (Sheet 1 of 2)

Supply System

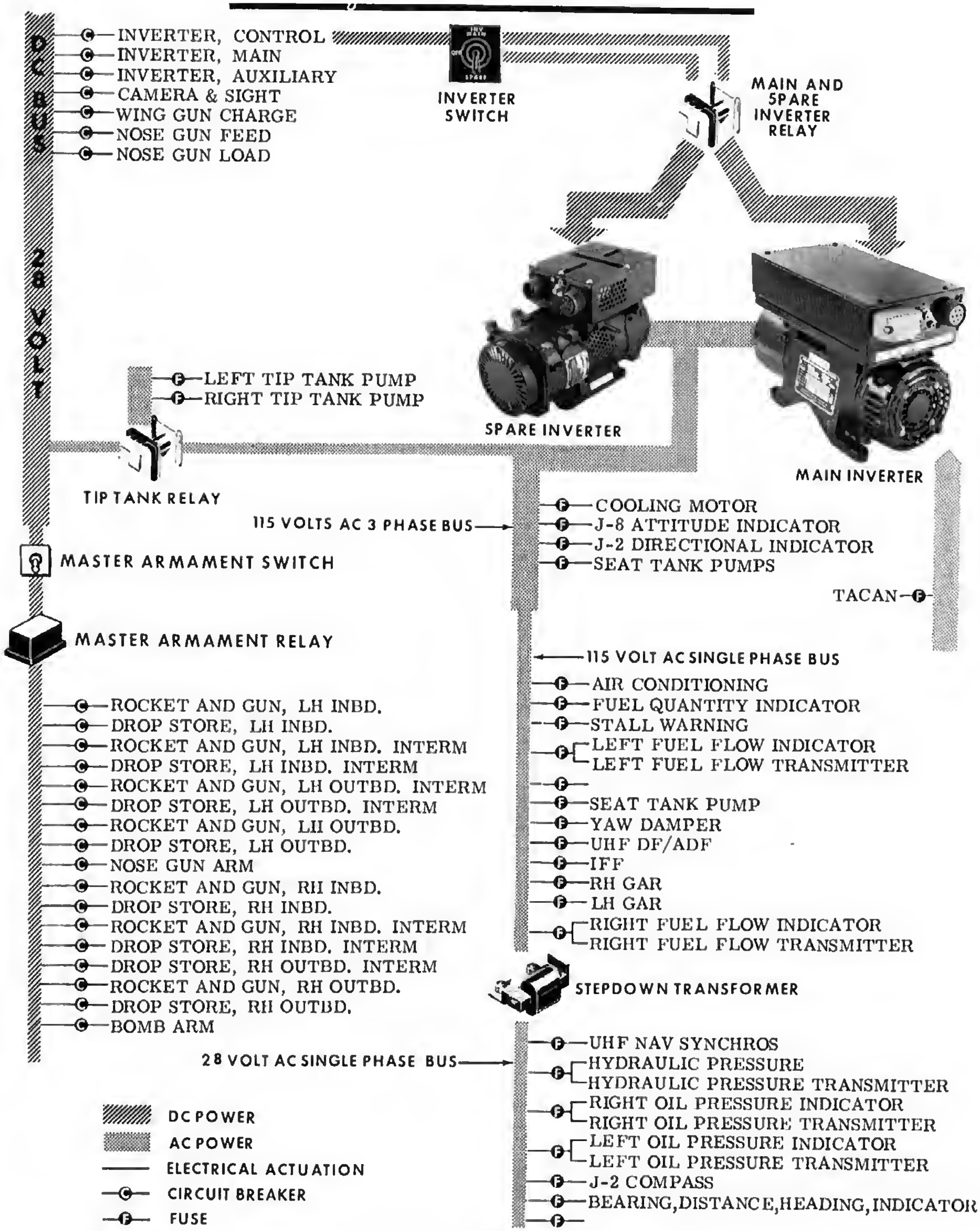


Figure 1-12 (Sheet 2 of 2)

FUEL DEFUELING VALVE

A defueling valve, located in the lowest point of the fuselage fuel tank serves as a means to defuel the aircraft or drain sediment and condensation from the fuselage fuel tank. The defueling valve has three positions, drain, off and bleed. Access to the defueling valve is gained through an access door located on the center tunnel access door and is not accessible during flight.

ELECTRICAL POWER SUPPLY SYSTEM

For a complete reference of power distribution to electrically operated equipment, refer to figure 1-12.

DC ELECTRICAL POWER DISTRIBUTION

The 28 volt dc power supply system is powered by two engine-driven 300 ampere generators and two 24 volt 34-ampere-hour batteries. The batteries located in the left-hand nose section, are used to supply current to the dc bus if both generators fail. The dc generators function as starter-generators, cranking the engines until the engines have accelerated to operational speed and then cutting in as generators after engine speed reaches approximately 48 to 52% rpm. Higher than 65% rpm may be required for the generators to carry the equipment load and/or to compensate for low battery conditions. The generators and generator controls are protected by circuit breakers located in the left-hand nose section.

EXTERNAL POWER RECEPTACLE

The dc power system can be connected to an external power source through the external power receptacle (figure 1-48), located on the left-hand nose section.

DC CIRCUIT BREAKERS

The dc electrical power supply system is protected by push-pull type circuit breakers (figure 1-11) mounted on two separate panels. The circuit breaker for the canopy is located on a panel in the left-hand nose section and is not accessible during flight. The remaining circuit breakers are located on the right side of the cockpits. The circuit breakers function to protect the dc power system by disengaging automatically whenever an overload or short circuit exists. Should a circuit breaker pop out, it can be reset by manually pushing in on the circuit breaker. A dc circuit can also be opened manually by pulling out on the respective circuit breaker for that line.

CAUTION

Circuit breakers should not be pulled or reset without a thorough understanding of all the effects and results. Use of the circuit breakers can eliminate from the system some related warning system or interlocking circuit. A circuit breaker that continues to pop out after being reset, could result in an electrical fire and further attempts to reset it should be discontinued.

BATTERY SWITCH

The battery switch (13, figure 1-7), has three positions, ON, OFF, and SERIES START, which control the circuit accordingly. When the switch is in the ON position, the batteries are connected in parallel. In the SERIES START position the batteries are connected in series to provide additional starting power for engine starting. In the OFF position 28 volt dc power is disconnected.

GENERATOR SWITCHES

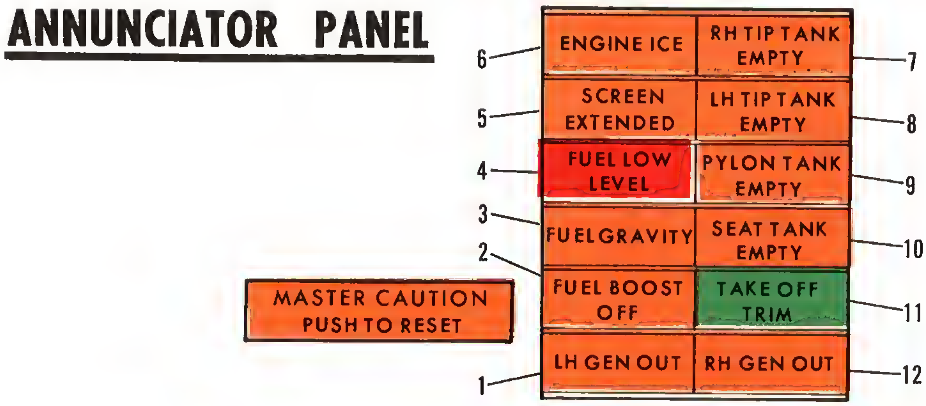
The guarded dc generator switches (12, 14, figure 1-7), have two positions, ON and OFF and function to connect generator output to the 28 volt dc bus. Generator warning lights (1, 12, figure 1-13), are on the annunciator panel and will illuminate when a generator failure has occurred.

LOADMETERS

The loadmeters (27, figure 1-5), one for each generator, are calibrated to read from -.2 to +1.2 and indicate the proportion of generator rated output being used.

AC ELECTRICAL POWER DISTRIBUTION

The ac power supply system is powered by a 2500 va three phase 400 cycle main inverter. A spare inverter of 750 va three phase 400 cycle is provided as a safety feature and when manually selected will assume the ac load of the aircraft, except the TACAN, if the main inverter fails. Alternating current is distributed through three bus networks, and by the use of a transformer, supplies separate voltage systems. Power for the inverters is supplied by the aircraft's dc system.



1. LH GEN OUT
2. FUEL BOOST OFF
3. FUEL GRAVITY
4. FUEL LOW LEVEL
5. SCREEN EXTENDED
6. ENGINE ICE
7. RH TIP TANK EMPTY
8. LH TIP TANK EMPTY
9. PYLON TANK EMPTY
10. SEAT TANK EMPTY
11. TAKE OFF TRIM
12. RH GEN OUT

Figure 1-13

INVERTER SWITCH

The inverter switch (11, figure 1-7), has three positions; MAIN, which is the position for all normal operation; SPARE, for manually selecting the spare inverter if the main inverter fails; and OFF. Normally, the main inverter supplies power for all ac operated equipment. Inverter failure can be detected by observing the INVERTER OUT light above the rounds counter on the instrument panel. Selection of the other inverter will turn the light out.

CAUTION

Ground operation limited to 15 minutes, then select other inverter to allow for cooling.

AC FUSES

All of the ac circuits are protected by fuses (figure 1-11) which are replaceable during flight. Spare fuses are located above the dc circuit breaker panel on the under side of the glare shield.

ANNUNCIATOR PANEL AND WARNING LIGHTS

The annunciator panel and warning lights (figure 1-13) are located below the gunsight on the upper portion of the instrument panel. The inverter out warning light is located above the rounds counter; the canopy not locked light and the landing gear position lights are located to the left of the gunsight light rheostat. They are instrumented to reduce surveillance to a minimum and warn the pilot of malfunctions. The lights receive their power from the 28 volt dc bus.

The annunciator panel contains twelve warning and indicator lights. When a safety of flight condition exists, one of the red warning lights will illuminate. When a condition exists that requires corrective action, but is not a safety of flight condition, an amber indicator light will illuminate. When a condition exists that is worthy of note, a green indicator light will illuminate. Five of the lights on the annunciator panel will illuminate in conjunction with a "Master Caution" light. Indicator lights that illuminate in conjunction with the "Master Caution" light are: Engine Ice, Screen Extended, Fuel Low Level, Fuel Gravity and Fuel Boost Off.

Master Caution Light

The Master Caution light (figure 1-13) operates in conjunction with the annunciator panel lights. It is only necessary to monitor the "Master Caution" light for an indication of a condition requiring attention and then referring to the annunciator panel for the specific condition. The "Master Caution" light may be extinguished by depressing the "Master Caution" light, this will clear the light for any additional condition that requires attention. The "Master Caution" light receives its power from the 28 volt dc bus.

ENGINE FIRE DETECT SYSTEM

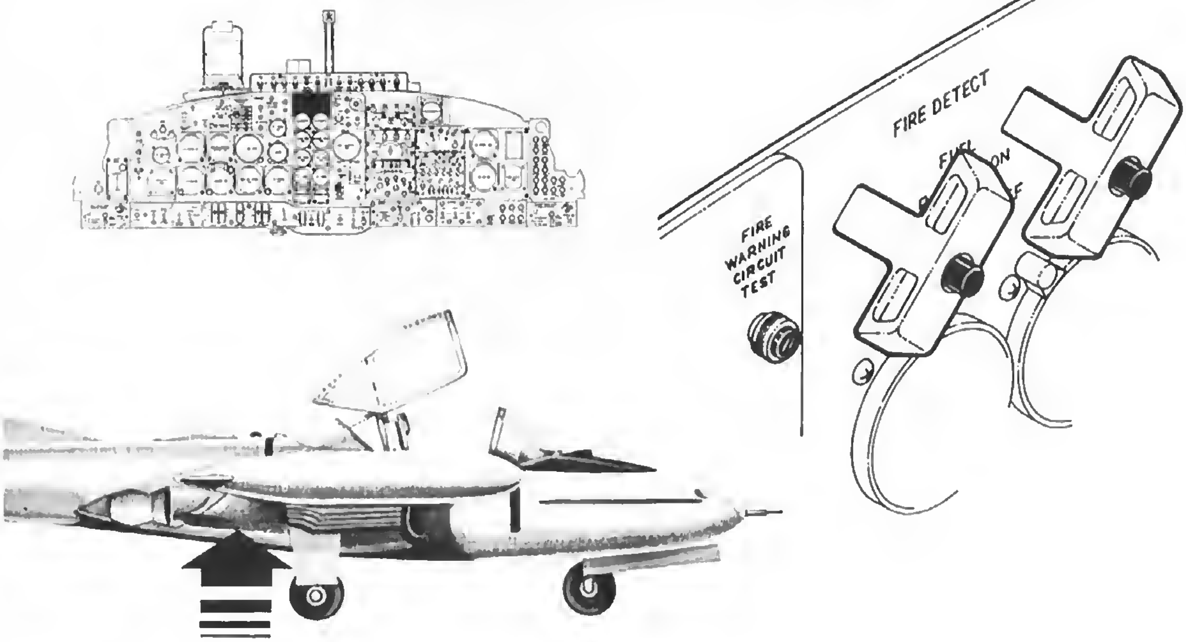


Figure 1-14

Warning Lights Dimming Switch

The warning lights dimming switch (2, figure 1-7), has two positions: BRIGHT and DIM. The switch controls the intensity of all the warning lights. The circuit receives its power from the 28 volt dc bus, and is protected by an individual circuit breaker.

Annunciator Panel Test Switch

The annunciator panel test switch (10, figure 1-5), is to the right of the panel. Depressing this switch will test all of the warning lights on the panel, if any fail to light the bulb should be replaced. The test switch receives its power from the 28 volt dc bus.

ENGINE FIRE DETECT SYSTEM

An engine fire detect system (figure 1-14) is provided to show a visible warning of a fire in either nacelle. A heat sensitive detector cable is installed in each nacelle compartment and is electrically connected to the warning lights in the cockpit.

Engine Fire Detect Warning Lights

The warning lights are mounted in the fuel shutoff "T" handles. A steady illumination of the red warning light indicates a fire in the corresponding engine nacelle compartments. Operation of the fire detect system and lights can be checked by the system test switches. The lights receive their power from the 28 volt dc bus.

Engine Fire Detect Switches

The fire detect test switch (12, figure 1-5), when pressed, energizes the entire fire detect circuit and a steady red light in both fuel shutoff "T" handles should come on. The switch receives its power from the 28 volt dc bus.

Note

> Pressing to test the light in the fuel shutoff "T" handle only checks the bulb and does not check the fire circuit.

HYDRAULIC POWER SUPPLY SYSTEM

The hydraulic power supply system (figure 1-15) consists of two engine-driven hydraulic pumps, one on each engine. Either pump is capable of maintaining full system pressure with only a slight increase in actuation time. The system supplies power to actuate the hydraulic components of the aircraft. Normal operation of the hydraulic power supply system is automatic when the engines are running. Any sudden surges in the system are absorbed by an air-charged (600 psi) accumulator. A pressure regulator maintains a pressure of 1250 to 1550 psi on the system at all times during operation; however, a pressure relief valve, spring-loaded to relieve at a slightly higher pressure, protects the system in case of regulator failure. An air bottle, located in the nose

wheel well is used for emergency landing gear extension in case of hydraulic power failure. Refer to figure 1-48 for hydraulic fluid specification.

Note

Occasionally a thumping noise may occur as the hydraulic pressure regulator recycles. This can be seen on the hydraulic gauge when it occurs. This noise is common and should not be confused with engine malfunction.

HYDRAULIC SYSTEM PRESSURE INDICATOR

The hydraulic pressure indicator (13, figure 1-5) is a remote indicating instrument, and is operated by the 28 volt single phase 400 cycle ac bus. The indicator indicates hydraulic pressure in pounds per square inch.

LANDING GEAR SYSTEM

The conventional tricycle landing gear retracts and extends by power from the aircraft hydraulic power supply system. The landing gear positions are controlled mechanically by using the landing gear lever (3, figure 1-2). The main gear retracts inboard into the lower surface of the wing, and the nose gear retracts forward into the nose section of the fuselage. Each main gear has two doors; inboard and outboard. The nose gear is faired by split-type doors. The inboard main gear doors are actuated hydraulically and are operated by a sequencing valve in the landing gear system which synchronizes their opening and closing with the extension and retraction of the main gears. They return to the closed position after the landing gear is extended. The inboard main gear doors engage in the uplock hooks, which are hinged to the wing structure and assist in supporting the main gears in the up position. The outboard main gear doors are hinged to the wing and fastened on the bottom to the main gear strut. The nose wheel doors are actuated open and closed by mechanical linkages which are connected to the nose gear. Landing gear and door retraction time is approximately 10 seconds, while extension requires about eight seconds.

LANDING GEAR LEVER

The landing gear lever (3, figure 1-2) is a clear plastic wheel-shaped knob. The lever has two marked positions, UP and DOWN. Positioning the landing gear lever to the UP or DOWN position causes the landing gear to retract or extend when the weight of the aircraft is off the gear. The landing gear lever incorporates a solenoid which holds the lever in the DOWN position as long as the landing gear safety limit switch is de-energized.

LANDING GEAR EMERGENCY OVERRIDE SWITCH

A landing gear emergency override switch (3, figure 1-2) is provided. The purpose of this switch is to supply electrical power to the solenoid lock which holds the landing gear levers in the DOWN position. Pressing the override switch and simultaneously lifting the landing gear lever will allow the landing gear to collapse while the weight of the aircraft is on the landing gear. Refer to figure 1-2, Landing Gear Override Switch. The landing gear emergency override switch receives its power from the 28 volt dc bus.

LANDING GEAR POSITION INDICATOR LIGHTS

There are three landing gear position indicator lights (3, figure 1-5). Each will illuminate when its respective gear is down and locked. Power is supplied by the 28 volt dc bus.

LANDING GEAR WARNING LIGHT AND AUDIBLE SYSTEM

A red warning light, located in the wheel-shaped knob on the landing gear lever (3, figure 1-2) will illuminate at any time the landing gear is not in the fully locked position and electrical power is available. When a throttle is retarded to approximately 54% rpm and the gear is not down and locked, the light will be illuminated and the warning signal will send an audio tone to both the pilot's and copilot's headsets. The warning lights can be checked by pressing the test switch (2, figure 1-2). The landing gear audible silencing switches (1, figure 1-7), will silence the warning signal but will automatically be reset each time the retarded throttle(s) is advanced past approximately 54±3%. Power to operate the landing gear warning light switch and gear audible warning signal system silencing switches is received from the 28 volt dc bus.

LANDING GEAR EMERGENCY EXTENSION SYSTEM

The landing gear emergency extension system consists of an emergency gear "T" handle (20, figure 1-2), and emergency air bottle located on the nose compartment. The system contains approximately 2000 ±250 psi of air which is indicated on the pressure gauge near the air bottle. When the landing gear lever is placed in the DOWN position and the emergency gear "T" handle is turned and pulled, air is directed to the shuttle valve and gear lowering hydraulic lines, to open the gear doors and lower the landing gear. When this system is used, no attempt to retract the gear should be made because rupturing of the hydraulic reservoir can result.

Hydraulic Power

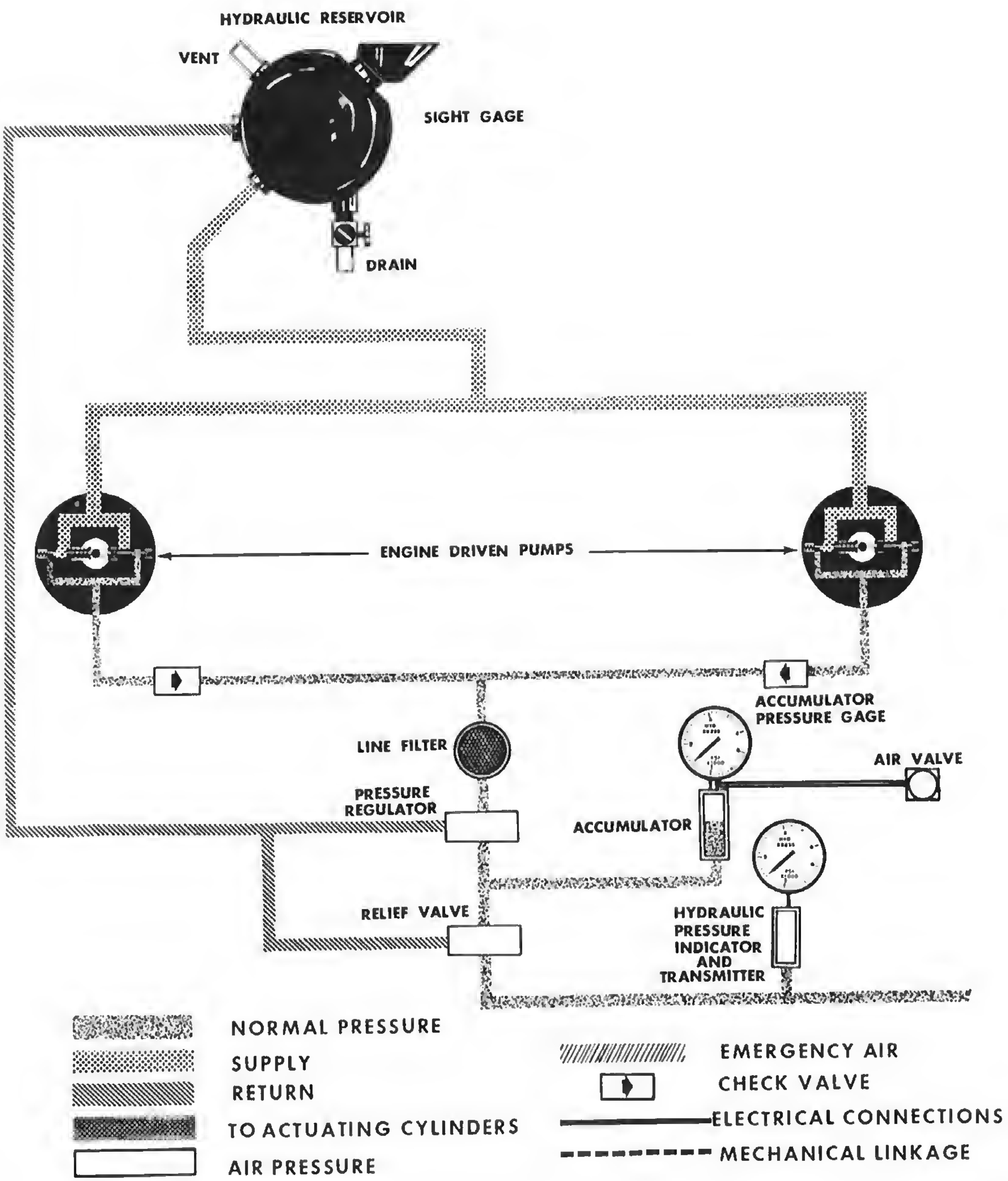


Figure 1-15 (Sheet 1 of 2)

Supply System

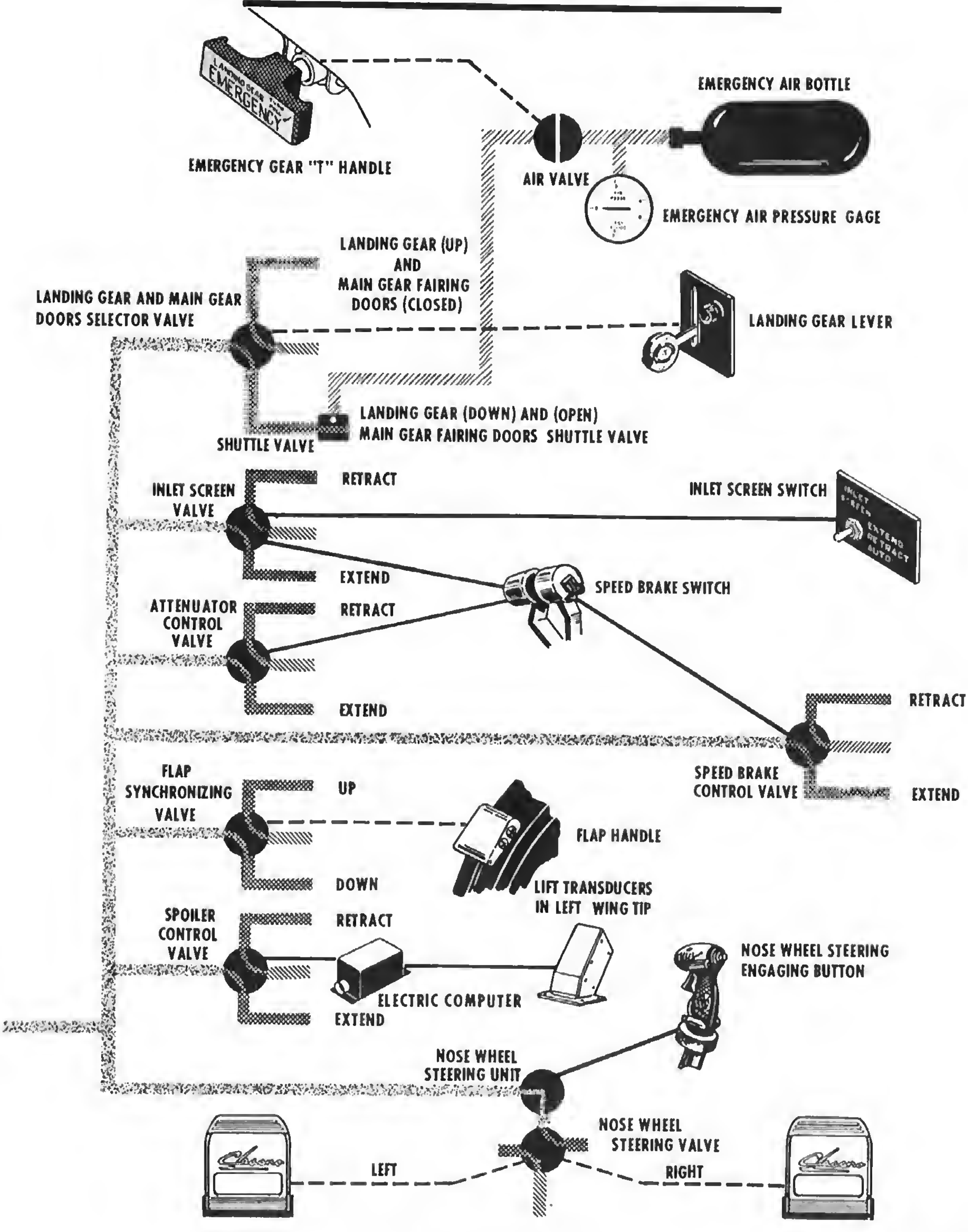


Figure 1-15 (Sheet 2 of 2)

NOSE WHEEL STEERING SYSTEM

The nose wheel steering system is provided for directional control during taxiing and for portions of the takeoff and landing roll as desired. The system is electrically engaged, and controlled by the rudder pedals, and powered by the hydraulic power supply system. Steering is engaged by a switch on each control stick grip. The hydraulically powered nose wheel steering unit will position the nose wheel within approximately 40 degrees of each side of center when the aircraft is on the ground. The nose wheel can swivel to 50 degrees either side of center when wheel brakes are used. The steer-damper, controlled by rudder pedal movement, directs the hydraulic fluid to an actuator which turns the nose gear strut. The steer-damper device serves two purposes; during power controlled operations it steers the nose wheel, and it serves as a shimmy damper with power on or off. Nose wheel steering may be selected at any time while the weight of the aircraft is on the nose wheel, and hydraulic and electrical power is available. The nose gear centering spring centers the nose gear strut during retraction and extension operations. Regardless of the position of the nose gear when the aircraft is on the ground, when the nose gear steering switch is actuated, the nose gear will turn to correspond to the position of the rudder pedals. In the event of a complete hydraulic or electrical failure steering is inoperative. Steering is then accomplished by rudder movement. All electrical components used to operate the nose wheel steering mechanisms are powered by current from the 28 volt dc bus.

Note

> Nose wheel steering response is very slow at higher gross weights and wheel brakes must be used in conjunction with nose wheel steering to accomplish short radius turns.

NOSE WHEEL STEERING SWITCH

When the nose wheel steering switch (5, figure 1-19) is depressed and released, power from the 28 volt dc bus actuates a solenoid shutoff valve, which permits hydraulic pressure to be supplied to the nose wheel steering system. To disengage the system the nose wheel steering switch must be depressed again and released. A limit switch on the nose gear prevents turning the nose wheel when weight is not on the nose gear; the system is automatically deactivated.

BRAKE SYSTEM

The brake system is a manually operated, independent, hydraulic system set apart from the hydraulic power supply system. The brakes are multi-disc type and are actuated by toe pressure applied to either set of rudder pedals. No emergency braking provisions are provided on the aircraft.

PARKING BRAKE

Setting the brakes is accomplished by applying toe pressure to the rudder pedals and pulling out on the parking brake handle (18, figure 1-2). To release the parking brakes, apply toe pressure to either set of rudder pedals.

CAUTION

> Use wheel chocks instead of parking brakes whenever possible. Use of the parking brake after heavy braking may cause the brakes to lock.

SPEED BRAKE AND THRUST ATTENUATOR SYSTEM

The speed brake and thrust attenuators operate hydraulically through one system, using separate control valves. Both control valves are energized open by power from the 28 volt dc bus and are spring-loaded to the closed position.

SPEED BRAKE

The speed brake is located on the bottom side of the nose section just aft of the nose wheel well. The speed brake is hinged at the forward edge and when opened, extends down into the airstream. When retracted, the speed brake closes flush with the fuselage. There are no intermediate opened or closed positions, and there is no position indicator.

Speed Brake Switch

Each right engine throttle contains a speed brake switch (8, 11, figure 1-6), which electrically actuates the speed brake selector valve and the thrust attenuator selector valve. Each speed brake switch is marked IN and OUT with a SOLO override position included in the copilot's switch. The speed brake cannot be extended or retracted by the pilot until the copilot's speed brake switch is positioned to SOLO.

THRUST ATTENUATORS

The function of the thrust attenuator (figure 1-18) is to reduce effective thrust and still maintain a higher engine rpm. The thrust attenuators operate simultaneously with the speed brake when either throttle on each quadrant is between idle and approximately 54± 3% rpm. The attenuators retract when one throttle is placed in the CUT-OFF position and the other is above approximately 54% rpm. The attenuators are primarily used for taxiing.

Figure 1-16

WING FLAP SYSTEM

The hydraulically operated wing flaps are partial span, slotted, trailing edge type and extend from the aileron to the engine nacelle on each wing. The wing flaps are actuated by wing flap levers to any position. A flap blow up relief valve provides a slight wing flap retraction when the airspeed for flap down configuration is exceeded. A synchronizing unit insures the extension of both flaps at the same rate with a maximum divergence of three degrees.

WING FLAP LEVERS

The wing flap levers (4, 17, figure 1-6) are labeled Flaps and have three marked positions; UP, 1/2, and DOWN with a detent at the 1/2 position. The wing flap levers are mechanically connected to a flap selector valve. The flap selector valve governs the total travel distance of the flap actuating cylinders, permitting a flap down position of any desired setting.

WING FLAP POSITION INDICATOR

Position of the wing flaps is indicated by a 28 volt dc operated wing flap position indicator (2, figure 1-5). The indicator is marked in 10% increments from zero to 100% with 40 degrees of flap extension being 100% deflection

HALF FLAP STOP

A mechanical 1/2 flap stop is provided to prevent the lowering of more than 1/2 flaps. The latch is a hook latch that may be removed in flight, if necessary, and allowed to hang free. The latch is located on both consoles next to the flap handle. Removal of the latch will allow selection of full flaps.

SPOILERS

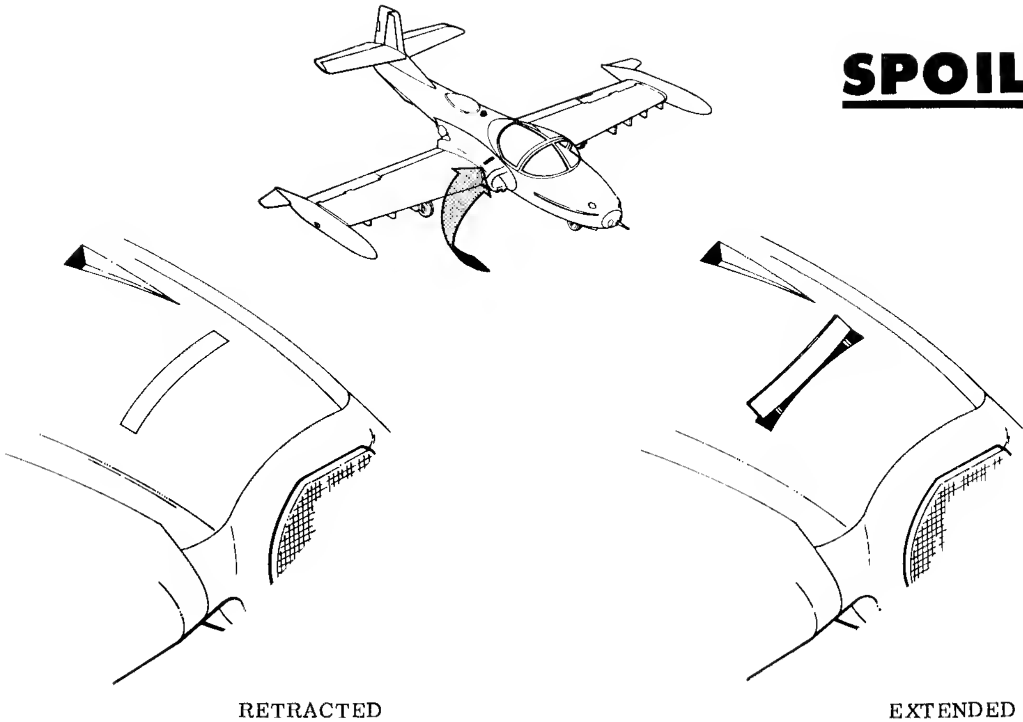


Figure 1-17

SPOILER SYSTEM

The purpose of the spoilers (figure 1-17) is to provide sufficient stall warning for configuration with flaps extended. When the flaps are extended 25% or more, and the aircraft speed is reduced to 72 knots IAS or lower in level flight or proportionately higher speeds in accelerated and turning flight, a transducer vane located on the bottom of the left wing tip electrically actuates the hydraulically operated spoilers to the extended position. (When in the extended position, the spoilers create a turbulent airflow which is felt as aircraft buffet and occurs between four and 10 knots above the stall speed.) Either increasing the speed to stall speed +10 KIAS or higher in accelerated and turning flight or retracting the wing flaps to less than 25% will cause the spoilers to return to the retracted position.

FLIGHT CONTROL SYSTEM

The flight control system comprises two groups of control surfaces, primary and secondary. The primary control surface group includes ailerons, elevators, and rudder. The secondary control surface group includes trim tabs for left aileron, left elevator, and rudder. The function of the primary control surface group is to provide the pilot with a means of controlling the aircraft. All of the primary control surfaces are manually operated, through a system of cables, pulleys, bellcranks, and push-pull rods. The function of the secondary control surface group is to provide an aerodynamic control for the surface to which they are attached and serves to hold that surface at a position that will result in a balancing or trimming of the aircraft for any normal attitude of flight. All of the trim tabs are electrically operated and are controllable from the cockpit.

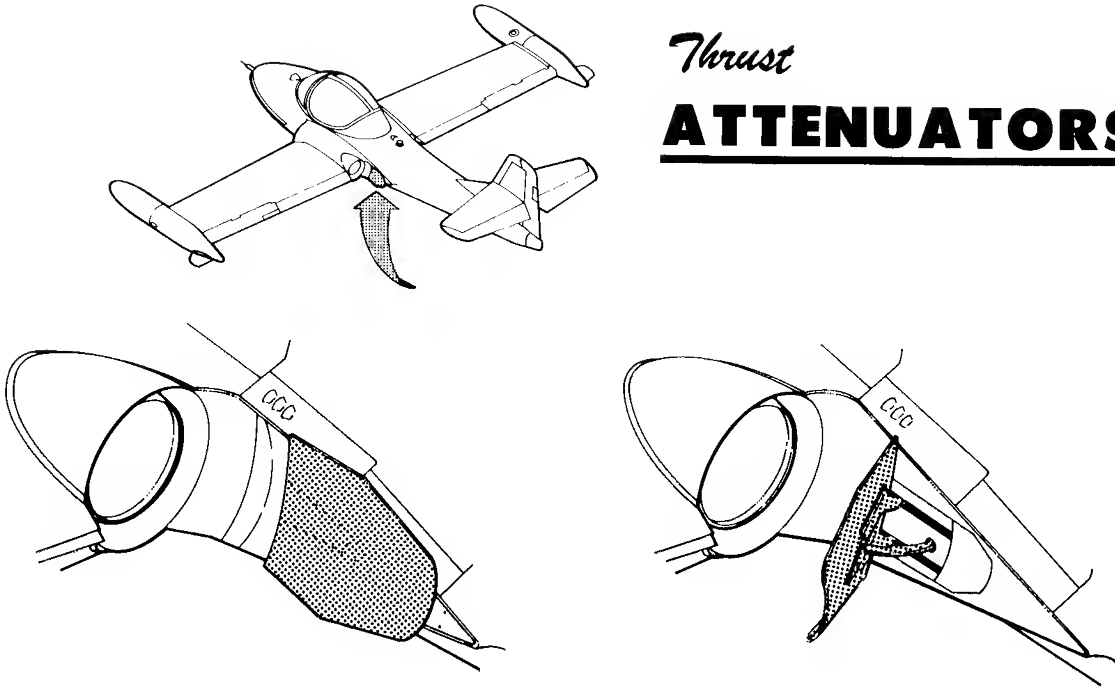
CONTROL STICK GRIP

Aileron and elevator control is maintained by dual control sticks on individual yokes, interconnected to permit control of the aircraft using either control stick. Each control stick has a typical fighter-type control stick grip (figure 1-19), which incorporates the aileron and elevator trim switch, nose wheel steering button, trigger, bomb/rocket button and yaw damper disconnect button. All are operative on the pilots stick grip. On the copilots stick grip only the aileron and elevator trim switch and nose wheel steering button are operative.

RUDDER PEDALS

Fore and aft movement on the rudder pedals controls the rudder position through mechanical linkage; toe pressure on the pedals operate the brakes. Each set of pedals is equipped with rudder pedal adjustments (14, figure 1-2).

Thrust ATTENUATORS



RETRACTED

EXTENDED

Figure 1-18

AILERON AND ELEVATOR TRIM TAB SWITCH

Normal trim of the aileron and elevator trim tabs is provided through a five position, momentary toggle type, aileron and elevator trim tab switch (2, figure 1-19). The switch receives its power from the 28 volt dc bus, and is spring-loaded to the center off position. Moving the trim tab switch to the left or to the right actuates the aileron trim motor. The motor is geared down and actuates a push-pull rod which in turn positions the aileron trim tab up or down - depending on which direction the switch was positioned. Pushing the switch forward or aft actuates the elevator trim tab motor. The elevator trim tab motor positions the elevator trim tab to the desired up or down position through a screwjack arrangement.

WARNING

To avoid any possibility of overtrim in the event of limit switch malfunction, the aileron and elevator trim tab switch should be manually returned to the OFF position.

ADJUSTABLE BOB WEIGHT

An adjustable bob weight is provided in the flight control system to harmonize stick forces and make the elevator stick force the same as the aileron for the various stores configurations of the aircraft. The bob weight is located just forward of the copilots control stick. A viewing window is provided for checking the position of the bob weight. The bob weight has three positions for Heavy, Normal and Light stick forces. Once the bob weight has been set on the ground there is no need to change it again until the next flight. The Heavy position is full clockwise rotation of the crank to the stop. This position is used with four fuel drop tanks and stores installed. The Normal position is in the center when the scribe is aligned with the centering mark on the shaft. This position is used in all normal flights and loadings. The Light position is full counterclockwise rotation of the crank to the stop. This position is used with four M117 GP bombs and stores loaded on the aircraft.

The pilot has a visual check, through the window and a feel check, by elevator movement force, on the ground as to the position of the bob weight. The bob weight will provide normal in flight stick forces for the elevator control when the two extreme conditions of CG movement are encountered with four fuel drop tanks or four M117 GP bombs.

CAUTION

- The bob weight should be set and checked by the pilot on preflight.
- When cranking the bob weight to full clockwise or full counterclockwise to the stop, do

not force the crank once the stop has been reached. Damage to the stop can result from unnecessary force.

- When set insure that crank is safety wired prior to flight.

TAKEOFF TRIM INDICATOR LIGHT

The takeoff trim indicator light (figure 1-13), on the annunciator panel will illuminate when the elevator tab is in the neutral position, and the battery switch is ON. The light receives its power from the 28 volt dc bus.

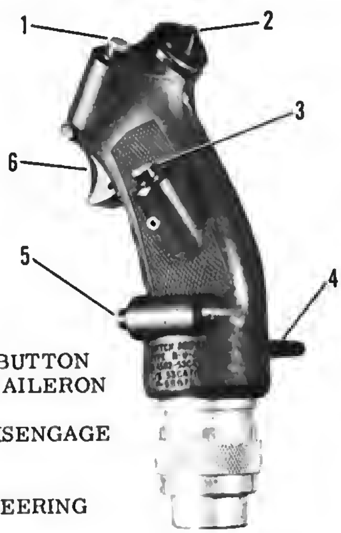
RUDDER TRIM TAB SWITCH

The rudder trim tab is electrically controlled through a switch (7, figure 1-6), mounted horizontally on the aft side of the pilot's quadrant. The switch is held to LEFT or RIGHT for corresponding rudder trim and spring-loaded to the OFF position. The rudder trim tab switch receives its power from the 28 volt dc bus.

CONTROL LOCK

Primary flight control surfaces can be locked in the neutral position by a control lock (figure 1-20), below the instrument panel on the pilot's side. When the control lock is rotated up and is attached to the control stick, all surface controls are locked in neutral and the throttles are locked in the IDLE thru CUT-OFF range.

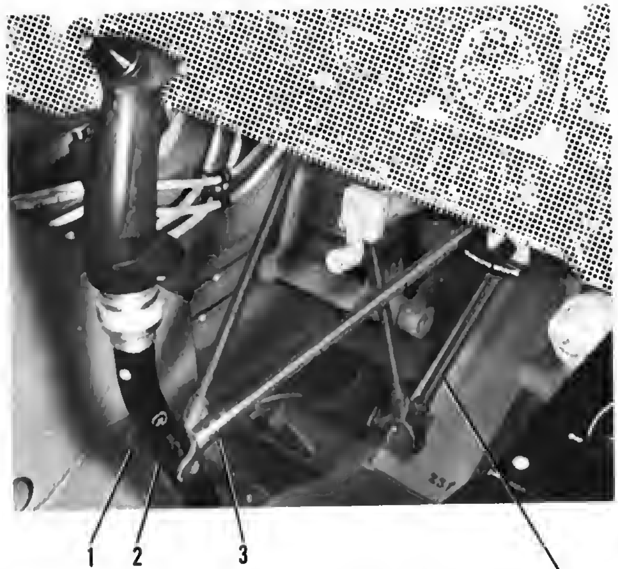
CONTROL STICK GRIP



1 BOMB/ROCKET BUTTON
2 ELEVATOR AND AILERON TRIM SWITCH
3 YAW DAMPER DISENGAGE SWITCH
4 HANDREST
5 NOSE WHEEL STEERING SWITCH
6 TRIGGER

Figure 1-19

CONTROL LOCK



CONTROL LOCK IN STOWED POSITION

1 PULL PIN
2 CONTROL STICK
3 CONTROL LOCK

Figure 1-20

YAW DAMPER SYSTEM

The yaw damper system controls the yaw oscillations of the aircraft, and increases the stability of the aircraft about its yaw axes, automatically co-ordinates all turns, compensates for asymmetrical store loadings. The yaw damper system contains a control channel and the yaw damper servo. The yaw damper servo, connected differentially to the rudder control system, controls the rudder in response to yaw signals initiated by the yaw rate gyro. It provides control response without corresponding movement of the rudder pedals. The yaw damper servo also controls the rudder to provide turn co-ordination in response to signals from the lateral accelerometer. However, the yaw damper system can be overridden by moving the rudder pedals to provide an intentional sideslip. The yaw damper system is controlled by the pilot operated yaw damper power switch located on the switch panel (15, figure 1-7). The switch is a two-position OFF-ON switch. Placing the switch in the ON position gives power to the yaw damper and places it in operation, placing the switch in the OFF position disconnects all power and leaves the system inoperative, a yaw damp disconnect button is provided on the control stick grip (3, figure 1-19) to disconnect the yaw damp system at anytime. To return to yaw damp operation, the switch must be placed in the ON position. The system receives its power from the 28 volt dc bus and is protected by a circuit breaker.

PITOT AND STALL WARNING TRANSDUCER VANE HEAT

PITOT HEAT SWITCH

The pitot tube, located in the nose section and the stall warning transducer vane located in the left wing tip, are heated by power from the 28 volt dc bus which is controlled by a pitot heat switch (16, figure 1-7). The switch has two positions, ON and OFF.

INSTRUMENTS

The flight and engine instruments are mounted on the left instrument panel (figure 1-5). An altimeter, turn and slip indicator, and airspeed indicator are also mounted on the right instrument and circuit breaker panel (figure 1-11).

ACCELEROMETER

The accelerometer (8, figure 1-2), indicates the positive and negative acceleration forces being exerted on the aircraft. One indicating needle records the positive "G" forces, one the negative "G" forces, and the other continuously indicates existing "G" loads. A push-to-reset knob on the lower left portion of the instrument resets the needles to the one "G" position.

J-8 ATTITUDE INDICATOR

A visual indication of the flight attitude of the aircraft in pitch and roll is provided by the Type J-8 attitude indicator. The unit is electrically operated and has an "OFF" indicator flag, which appears in the upper right arc of the dial whenever power is not being supplied. Within a range of 25 degrees in a climb or dive, the pitch attitude of the aircraft is indicated by displacement of the horizon bar in relation to the minature indicator aircraft. When the pitch attitude of the aircraft exceeds 25 degrees, the horizon bar remains in the extreme position and the sphere then serves as the reference. If the climb or dive angle is further increased with the aircraft approaching a vertical position, the attitude is indicated by graduations on the sphere. A controlled precession of 180 degrees occurs when the aircraft approaches 90 degrees in pitch. In a roll, the attitude of the aircraft is shown by the angular setting of the horizon bar with respect to the miniature indicator aircraft and by the relation of the bank index to the degree markings on the instrument case. After certain maneuvers, the attitude indicator will "lag" approximately 5 degrees upon return to straight and level flight. The indicator may be manually caged by use of the caging knob on the lower right side of the instrument. Caging is accomplished by smoothly pulling the knob away from the instrument and pushing it in, as soon as it reaches the limit of travel. The manual caging feature permits fast gyro erection for scramble takeoffs or for erecting the indicator to correct in-flight errors caused by turns or aerobatics. When the indicator is caged to correct in-flight errors, caging should be used only when the aircraft is in straight and level flight as determined by visual reference to a true horizon, since the indicator cages to the attitude of the aircraft. A knob on the lower left side of the instrument permits the miniature indicator aircraft to be adjusted to compensate for longitudinal trim changes. The attitude indicator receives its power from the 115 volt three phase ac bus and is protected by a fuse (figure 1-12).

CAUTION

During instrument conditions cross check between the vertical velocity indicator and the altimeter to insure positive rate of climb indications.

CAUTION

Hold in the caged position when turning on the inverter switch.

Note

Cage the J-8 attitude indicator prior to takeoff to insure proper erection.

J-2 HEADING INDICATOR

The heading indicator (33, figure 1-5) consists of a directional gyro that is automatically kept on the magnetic heading of the aircraft by a flux valve located in the horizontal stabilizer. Electrical power for the heading indicator system is supplied by the 28 volt dc bus and the 115 volt ac three-phase bus.

Note

Should either the dc or ac power supply fail, the heading indicator system is automatically disconnected from all electrical power.

The gyro is energized when the heading indicator circuit breaker is in, the inverter switch is in the MAIN or SPARE position, and the aircraft battery switch is ON, or when external power is applied and the inverter switch is in the MAIN or SPARE position. For the first two or three minutes of operation, the gyro is on a fast slaving cycle, during which it reaches operating speed and aligns with the magnetic heading of the aircraft. Then the gyro begins a slow slaving cycle.

Note

After the gyro reaches operating speed, observe the indicator and compare the indication with the actual heading of the aircraft by the indication of the magnetic compass. If the difference is over 5° the heading indicator is not operating properly and should be checked for malfunction.

Heading Indicator Cut-Out and Fast Slave Switch

The switch (7, figure 1-5) has three positions, OUT, IN, and FAST. When the switch is in the IN position, electrical power is supplied to the transmitter and the system operates as a slaved gyro heading indicator. Except for special circumstances, the switch should always be in the IN position. With the switch in the FAST position, it provides a means of stabilizing the gyro after it has been upset by overbanking or acrobatics. Holding switch in the FAST position interrupts 28 volt dc power to the indicator. When the switch is released, it will return to the IN position, and power will be restored and the fast slaving cycle is initiated to permit faster gyro recovery to the true heading. With the switch in the CUT-OUT position, the magnetic function of the heading indicator is discontinued by shutting off the power supply to the slaving torque motor. The CUT-OUT position of the switch is designed to navigate in polar areas where the excessive dip of the earth's magnetic field causes indications to become inaccurate. The heading indicator may still be used for a relatively accurate indication of heading change during turns.

CAUTION

- Since there is no means of resetting the reading to correct for gyro precession, the heading indicator should not be used for heading information when the cut-out and fast slave switch is in the OUT position.
- To avoid damage to the slaving torque motor, the switch should not be positioned to the FAST position too frequently. Allow 10 minutes between actuations, and hold switch no longer than two seconds.

MAGNETIC COMPASS

The magnetic compass (6, figure 1-2) can be used in the event of malfunctions of the heading indicator system. It requires no outside power source except for lighting of the instrument. A compass correction card (10, figure 1-2) indicates deviation in the system.

CLOCK

The clock (29, figure 1-5) contains an elapsed-time mechanism which uses a sweep-second hand and a minute totalizer. The elapsed-time mechanism is started, stopped, and reset by pushing in on the control knob located at the upper right-hand corner of the clock face.

TURN AND SLIP INDICATOR

The turn and slip indicators (36, figure 1-5) receive their power from the 28 volt dc bus. They operate whenever dc power is supplied to the aircraft.

PITOT STATIC INSTRUMENTS

Five flight instruments operate from the pitot static system. They include two airspeed indicators (35, figure 1-5); two altimeters (34, figure 1-5) and a vertical velocity indicator (30, figure 1-5).

ARMAMENT EQUIPMENT

The basic armament consists of a 7.62mm nose mounted minigun, four armament pylons located on the underside of each wing, a gunsight system directly in front of the pilot on the instrument panel glare shield, a gun camera on the glare shield and provisions for a strike camera or reconnaissance camera in the fuselage belly. The armament pylons have provisions for attaching fuel tanks and/or munitions.

MASTER ARMAMENT PANEL

The master armament panel located on the glare shield in the center of the cockpit contains all of the armament control switches. The lower portion of the panel contains the circuit breakers for the armament system. The armament system receives its power from the 28 volt dc bus.

ARMAMENT CONTROLS

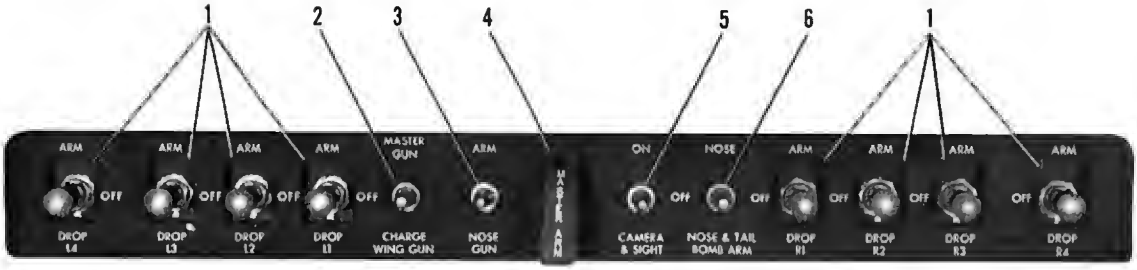
Master Armament Switch

A guarded master armament switch (4, figure 1-21) located in the center on the master armament panel, is used to control armament operation. The switch is marked MASTER ARM, is guard covered and has two positions, ON and OFF. The master armament switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11). When the master armament switch is placed in the ON position (cover raised) a relay is closed allowing 28 volt dc power to be connected to the rest of the armament switches. Each switch is protected by a circuit breaker on the lower portion of the master armament panel. With the cover closed the switch is returned to OFF, and all 28 volt dc power is desconnected from the master armament panel, except the charge wing gun switch and the camera and sight switch.

CAUTION

The master armament switch must be positioned OFF at all times, except when actually ready to activate the armament circuit.

MASTER ARMAMENT PANEL



1. PYLON SWITCH(ES)
2. MASTER GUN SWITCH
3. NOSE GUN ARM SWITCH
4. MASTER ARMAMENT SWITCH
5. CAMERA AND SIGHT SWITCH
6. BOMB ARM SWITCH

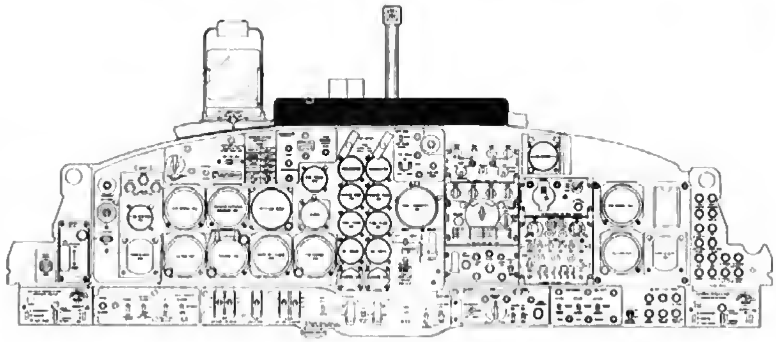


Figure 1-21

Armament Jettison Button

An armament jettison button (figure 1-22) located on the left instrument panel, is provided to jettison external stores in case of an emergency. The button is located in a recessed cup to prevent it from being pushed accidentally. When the button is pushed, a squib is fired which opens the pylon hooks and releases the external stores. Pylons remain attached to the aircraft. The button receives its power from the 28 volt dc bus and is protected by a circuit breaker. The battery switch does not have to be ON for the system to work.

Camera and Sight Switch

The camera and sight switch is a two-position switch, ON and OFF. In the ON position, 28 volt dc power is provided for gunsight reticle illumination through the gunsight light control. The gunsight light control rheostat will have to be turned toward the BRIGHT indication before illumination of the reticle can be seen. In the ON position 28 volt dc power is also provided for the gun camera, located on the glare shield. The first detent of the trigger, and the bomb/rocket button will cause camera operation to begin when the switch is in this position. In the OFF position all 28 volt dc power is disconnected.

Bomb Arm Switch

The bomb arm switch (6, figure 1-21) is located on the armament control panel. This switch is used when general purpose bombs are installed on the aircraft. The switch has three positions, NOSE, OFF, and NOSE and TAIL. With the switch in the NOSE position bombs are dropped nose armed. When the switch is in the OFF position the bombs are dropped safe. The NOSE and TAIL position arms both the nose and tail of the bomb when it is dropped. The switch receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

Nose Gun Switch

The nose gun switch provides 28 volt dc power for the operation of the 7.62mm nose gun. The switch has two positions, ARM, and OFF. In the ARM position the circuit to the nose gun is completed with the master gun switch in the MASTER GUN position and the trigger closed to fire the nose gun. In the OFF position 28 volt dc power is disconnected.

Master Gun Switch

The master gun switch controls the nose gun and pylon installed gun pods. It is a three-position switch MASTER GUN, OFF and CHARGE WING GUN. In the MASTER GUN position 28 volt dc power is provided to selected nose gun or pylon gun pods, when the trigger

is closed. In the CHARGE WING GUN position, 28 volt dc power is directed to the SUU-11A/A gun pod charge circuit to provide trickle charge for the pods batteries. When the switch is placed in the OFF position 28 volt dc power is disconnected. This and the camera and sight switch on the master armament panel are connected to a 28 volt dc source. All of the rest of the switches are inactive until the Master Arm switch is turned ON (cover raised).

Pylon Function Switches

There are eight pylon function switches. These are labeled and in a position to correspond to each pylon with the L1 through L4 to the left and R1 through R4 to the right. Each switch has three positions, ARM, OFF and DROP. In the ARM position the pylon hooks remain closed and 28 volt dc is directed to the electrical connector for actuation of installed dispensers when the bomb/rocket button is depressed. When the function switch is placed in the OFF position, power is disconnected. In the DROP position 28 volt dc power is directed to the pylon solenoid, when the bomb/rocket button is depressed, to open the hooks and allow stores to free fall from the rack. These switches are pull out type and must be placed to the desired position and then released, to prevent inadvertent movement.

Ground Arm Switch

The ground arm switch (2, figure 1-3) is located to the left and aft of the rudder trim switch on the left console and is used for testing armament on the ground. The switch is cover-guarded and spring-loaded to the safe position. When held in the ON position, the switch overrides the nose gear safety switch circuit. The switch is protected by a circuit breaker (figure 1-11) and receives its power from the 28 volt dc bus.

Trigger

The trigger (6, figure 1-19) located on the forward side of the control stick grip has two detent positions. With the camera and sight switch in the ON position, the first detent activates the gun camera circuit. With the nose gun switch at the ARM position and the trigger at the second detent (trigger fully depressed), the guns will fire and camera operation will continue.

Note

> When the camera and sight switch is in the ON position, the camera can be operated whenever desired by depressing the trigger to the first detent.

Bomb/Rocket Button

The bomb/rocket button (1, figure 1-19) is located on the left side of the pilot's control stick grip. This switch is used to release tanks, bombs or rockets depending upon the setting of the pylon function switches, and operate the gun camera when the camera and sight switch is ON. Placing the pylon switch in the ARM position will fire rockets or actuate dispensers. Placing the switch in DROP will drop any store on the pylon.

ARMAMENT JETTISON BUTTON

Figure 1-22

GUNSIGHT (FIXED RETICLE OPTICAL)

The gunsight (CA-503) (figure 1-23) has an illuminated reticle and an optical system consisting of a Mangin mirror and a depressible combining glass. The optical system produces a collimated reticle image which is reflected from the combining glass to produce the reticle image focused at infinity. The combining glass angle is adjustable by the pilot, producing a reticle image depression from 0 to 220 milliradians from the 0 mil reference line.

The sight has an etched metal reticle containing an outer 200-milliradian diameter broken circle and an inner 100-milliradian broken circle plus a center dot. This reticle is illuminated by three No. 1968 quartz iodide lamps wired in parallel. These 28 volt lamps produce an illuminated image of the reticle. The sight has a red 28 volt lamp located above the depression dial to provide illumination of the dial setting.

GUNSIGHT AND CAMERA

1 SIGHT GLASS
2 MIL DEPRESSION LEVER
3 RETICLE LIGHT SOURCE

4 CAMERA LENSE AND f/ STOPS
5 CAMERA CONTROLS
6 FILM MAGAZINE

Figure 1-23

The combining glass angle is manually adjusted by the pilot by means of a knob affixed to a graduated dial. This dial is integral with a circular cam which actuates a plunger pin to adjust the combining glass angle. The accuracy of a depression angle is ±2 mils at 150 mils depression and ±3 mils at 270 mils depression. The depression scale is calibrated in 2 mil units. With the lever at 0, the zero sight line is 2 degrees (34. 9 mils) above the fuselage reference line for parallel harmonization. The unit of measurement used to calibrate the sight is 1 degree = 17. 45 mils. The 270 mil depression is measured from this initial point. A total of 300 mils are available to the pilot without interference from the nose of the aircraft.

Mil Lead Control

When firing rockets (air-to-ground) or dropping bombs the mil lead is set at a predetermined angle. The desired lead angle varies with the dive angle and speed of the aircraft. The amount of lead or depression can be read from the index on the lever (2, figure 1-23).

GUNSIGHT LIGHT CONTROL

The gunsight light control (figure 1-24) located below and to the right of the sight on the instrument panel, is a rheostat.

The rheostat adjusts the intensity of the reticle image. When the sight is not in use, the rheostat shoulb be turned to DIM to prevent damage to the reticle bulb in the event of voltage surge. Turning the rheostat to BRIGHT increases the reticle brilliance. The rheostat and lights receive power from the 28 volt dc bus and are protected by a circuit breaker.

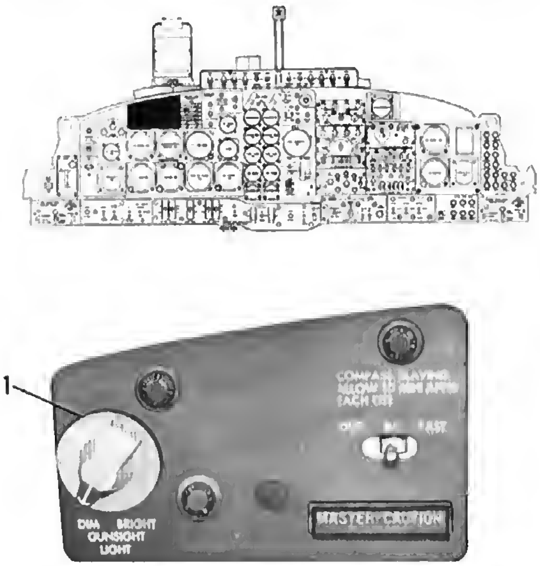
GUN CAMERA (KB-3A)

The gun camera is an electrically-driven magazine type, 16mm motion picture camera mounted on top of the armament control panel and to the right of the gunsight. The camera does not have the capability of photographing the sight reticle; only the target during gun, rocket and bomb runs. The film speed control, camera overrun time (0 to 3 seconds), and the shutter aperture control should be preset before takeoff to coincide with light conditions. However, film speed and shutter aperture, may be readjusted by the pilot during flight if conditions require readjustment of these settings.

Gun Camera Settings and Loading

The camera operating adjustment settings are on the right side of the camera, and should be set prior to flight. If adjustment is necessary there are three controls, the shutter aperture control, the overrun control and the speed control. The overrun control

GUNSIGHT LIGHT CONTROL



1 GUNSIGHT LIGHT CONTROL RHEOSTAT

Figure 1-24

must be fully depressed before attempting to reset, and the camera not operating if the speed control must be changed. The f stops are on the front of the camera and have a range from f/2.8 to f/22 and may be changed if necessary to agree with light conditions.

The magazine when loaded with film is ready for installation and use. When installing magazine to camera body make sure that dust and undesirable material is removed. Insert the magazine so that its locating pin enters the mating hole to the right of the camera aperture and the camera locating pin enters the slot near the back end of the magazine. Make sure the magazine cover is closed. Then press the rear of the magazine firmly against the camera body, swing magazine lock in place, and tighten the latch. The camera is ready for operation.

P220 STRIKE AND RECONNAISSANCE CAMERA

The P220 Strike and Reconnaissance Camera is a dual purpose camera located in the bottom of the fuselage just aft of the trailing edge of the wings. The camera consists of the camera body, sensor, computer and radio noise filter. The camera body is the main camera with its magazine cover, optical filter and lens cap. The sensor through the computer adjusts the lens diaphragm control by sensing the outside light conditions. The computer through its ground presettings, adjusts the lens diaphragm according to the light received by the sensor. The camera produces a 2-1/4 by 2-1/4 inch picture size for strike and reconnaissance assessment. The camera is mounted on a movable frame and can be varied from 0° to 60° aft of a vertical position. The pilot will have no control over the camera computer and variable axes; these will be set before flight. Power is provided for operation of the camera and thermostatically controlled heaters to allow operation over a temperature range of -54°C to 71°C, by the 28 volt dc bus.

The camera has two controls. The strike camera power switch (figure 1-25) located on the left console aft of the rudder trim switch, and an intervalometer located aft of the intercommunications panel.

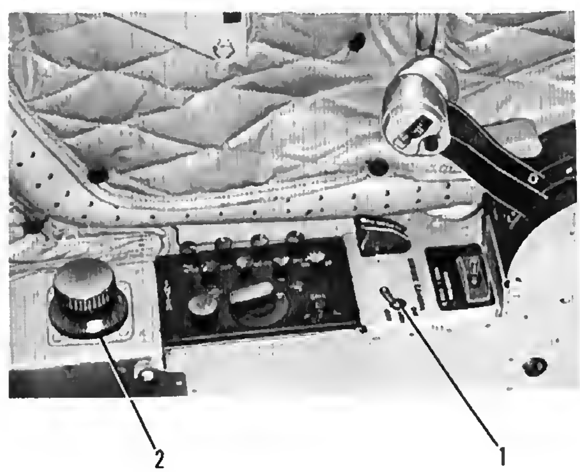
Strike Camera Power Switch

The strike camera power switch (figure 1-25) has three positions, ON, STBY, and OFF. In the ON position the 28 volt dc power is directed to the intervalometer and then to the camera for operation. In the STBY position 28 volt dc power is directed to the camera thermostat controlled heaters. Heat is required for camera operation when operating at 0°C and below. In the OFF position power is disconnected. A circuit breaker protects the camera circuit (figure 1-11).

Strike Camera Intervalometer

The camera intervalometer causes the camera to function and has an OFF position with graduated intervals of .2 second indications or marks. These graduations are from .2 second to 6.0 seconds, to provide

STRIKE AND RECONNAISSANCE CAMERA CONTROL PANELS



1. STRIKE CAMERA POWER SWITCH
2. STRIKE CAMERA INTERVALOMETER

Figure 1-25

a range of pulse intervals for camera operation. In the OFF position power to the camera shutter and magazine is disconnected. When the dial is rotated from the OFF position, and the camera power switch is ON, the intervalometer will pulse at the set interval on the dial and the camera will function with each pulse, until either the intervalometer is returned to OFF or the camera switch is turned OFF.

ARMAMENT SYSTEM OPERATION

NOSE GUN

To fire the nose gun using the gunsight and camera, proceed as follows:

1. Camera and sight switch - ON.
2. Gunsight light control - AS DESIRED.
3. Nose gun switch - ARM.
4. Master gun switch - MASTER GUN.
5. Mil lead - SET.
6. Master armament switch - ON (cover open).
7. Trigger - DEPRESS.

GUN PODS

To fire gun pods when installed using the gunsight and camera, proceed as follows:

1. Camera and sight switch - ON.
2. Gunsight light control - AS DESIRED.
3. Pylon function switch - ARM for pylon(s) with pod installed.
4. Master gun switch - MASTER GUN.
5. Mil lead - SET.
6. Master armament switch - ON (cover open).
7. Trigger - DEPRESS.

ROCKET FIRING

To fire rockets using the gunsight, proceed as follows:

1. Camera and sight switch - ON.
2. Gunsight light control - AS DESIRED.
3. Pylon function switch - ARM for pylon(s) with pod installed.
4. Mil lead - SET.
5. Master armament switch - ON (cover open).
6. Bomb/rocket button - DEPRESS.

GP BOMB RELEASE

To release GP bombs proceed as follows:

1. Camera and sight switch - ON.
2. Gunsight light control - AS DESIRED.
3. Pylon function switch - DROP.
4. Bomb arm switch - NOSE or NOSE and TAIL.
5. Mil lead - SET.
6. Master armament switch - ON (cover open).
7. Bomb/rocket button - DEPRESS.

CBU RELEASE

To release CBU stores proceed as follows:

1. Camera and sight switch - ON.
2. Gunsight light control - AS DESIRED.
3. Pylon function switch - ARM if dispenser is to remain on the pylon. DROP if dispenser is to be released.
4. Bomb arm switch - NOSE or NOSE and TAIL (if dispenser is to be released).
5. Mil lead - SET.
6. Master armament switch - ON (cover open).
7. Bomb/rocket button - DEPRESS.

FLARE RELEASE

To release flares proceed as follows:

1. Camera and sight switch - ON.
2. Gunsight light control - AS DESIRED.
3. Pylon function switch - ARM.
4. Mil lead - SET.
5. Master armament switch - ON (cover open).
6. Bomb/rocket button - DEPRESS.

PRACTICE BOMBS AND ROCKETS

To release practice bombs or rockets from the SUU-20/A proceed as follows:

1. Camera and sight switch - ON.
2. Gunsight light control - AS DESIRED.
3. Pylon function switch - DROP for bombs, ARM for rockets.
4. Mil lead - SET.
5. Master armament switch - ON (cover open).
6. Bomb/rocket button - DEPRESS.

GUN CAMERA

To photograph actual or practice runs for later assessment proceed as follows:

1. Camera and sight switch - ON.
2. Gunsight light control - AS DESIRED.
3. Trigger or bomb/rocket button - DEPRESS. (Trigger to the first detent.)

STRIKE AND RECONNAISSANCE CAMERA

To photograph for strike or reconnaissance assessment proceed as follows:

1. Intervalometer - SET as desired as to the number of seconds between each picture.
2. Strike camera control switch - ON. OFF to stop the camera operation.

Note

If camera operation is required to operate at temperatures below 0°C (32°F), it is recommended to place the strike camera switch to "STBY" position prior to any anticipated use, to allow the camera and magazine heaters to attain operating temperatures.

COMMUNICATIONS and ASSOCIATED ELECTRONIC EQUIPMENT

TYPE	DESIGNATION	USE	OPERATOR	RANGE	LOCATION OF CONTROLS
Inter-communication	AN/AIC-18	Pilot and copilot Intercommunication	Pilot or Copilot	Cockpit	Pilot's left side Cockpit Copilot's right side Cockpit
UHF Command Radio	AN/ARC-133	Two-way voice Communication	Pilot or Copilot	Line-of-sight	Stationary Instrument Panel
UHF/ADF	ARA-50	Aircraft-to-aircraft Aircraft-to-ground	Pilot or Copilot	Line-of-sight	UHF Radio Panel
VHF/FM Communication	Magnavox FM622	Two-way voice Communication	Pilot or Copilot	Line-of-sight	Stationary Instrument Panel
FM Homing	AN/ARA-56	Aircraft-to-aircraft Aircraft-to-ground Homing	Pilot or Copilot	Line-of-sight	VHF/FM Radio Panel
Secure Voice	KY-28	Voice Scramble	Pilot or Copilot	Line-of-sight	Stationary Instrument Panel
UHF Navigation	TACAN AN/ARN-65	Range Distance and Bearing Information	Pilot or Copilot	Line-of-sight up to 195 miles	Stationary Instrument Panel
Identification Transponder	IFF/SIF AN/APX-64	Automatic and Selective Identification	Pilot or Copilot	Line-of-sight	Stationary Instrument Panel
X- Band Beacon	SST 181X	Radar Control	Pilot or Copilot	Line-of-sight	Auxiliary Fuze Panel
LF Navigation ADF Radio	AN/ARN-83	ADF and LF Receiver	Pilot or Copilot	Up to 200 miles	Aft of copilot's Quadrant

Antenna Locations

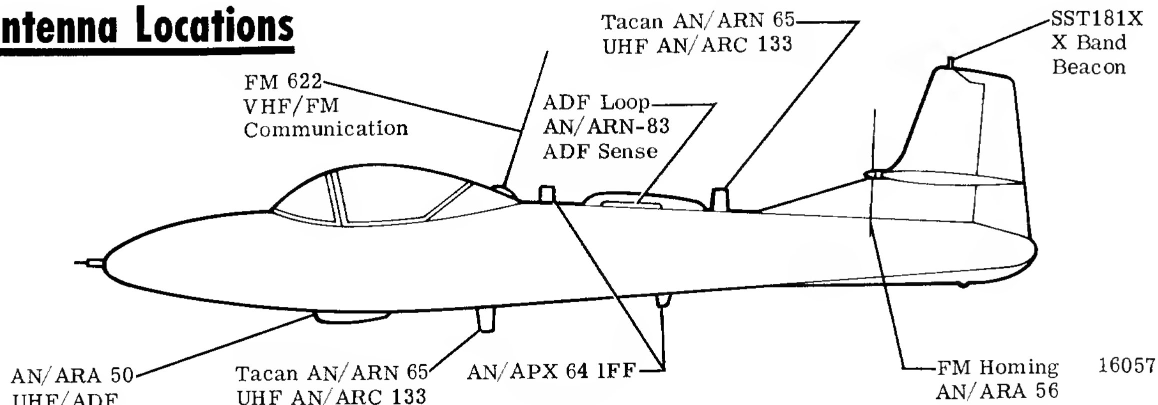
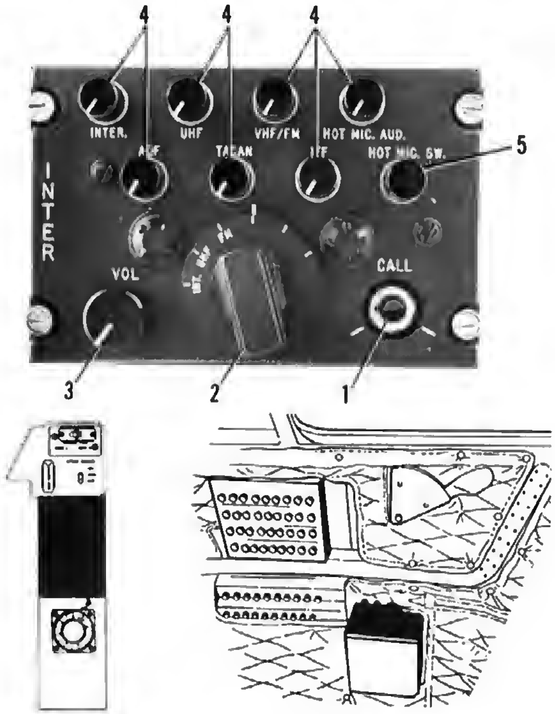


Figure 1-26

INTERCOMMUNICATION SYSTEM CONTROL PANEL



1. CALL BUTTON
2. TRANSMITTER ROTARY SELECTOR SWITCH
3. VOLUME CONTROL
4. MONITOR SWITCH-VOLUME CONTROLS
5. HOT MIC SWITCH

Figure 1-27

COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

TABLE OF COMMUNICATION AND ASSOCIATED ELECTRONIC EQUIPMENT

See figure 1-26.

ELECTRONIC EQUIPMENT COOLING.

An exhaust fan is provided in the tailcone for cooling of the electronic equipment. Air is exhausted through a louver in the aircraft skin to provide circulation. The fan is controlled by the nose gear squat switch and requires no action by the pilot. When the aircraft is on the ground 115 volt AC power is provided to the fan and is protected by a fuze on the fuze panel. Power is disconnected when the aircraft becomes airborne.

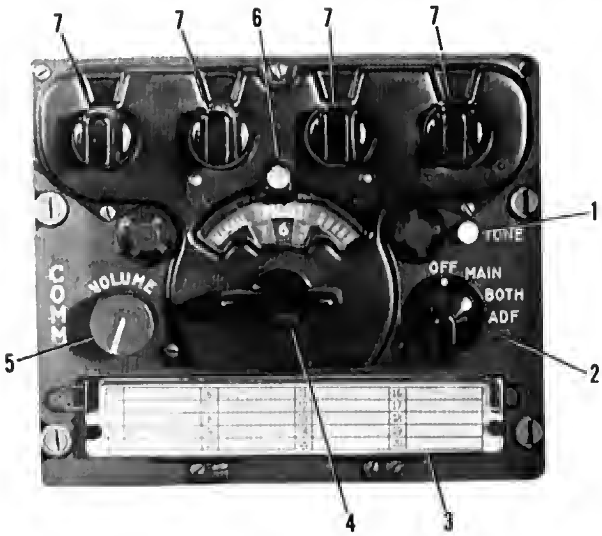
ANTENNA SELECT SWITCHES.

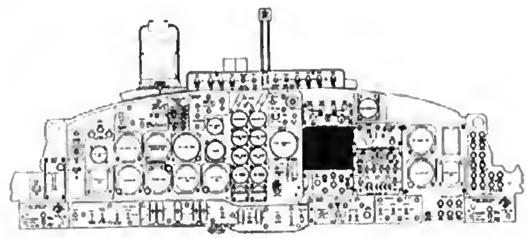
The antenna select switch panel located to the right of the switch panel, figure 1-7, contains three selector switches. The switches are for selection of antennas for the UHF, IFF and TACAN. Selection of UPPER, AUTO and LOWER can be made to obtain better reception or transmission of radio, navagation and radar signals. In the UPPER position the antennas on top of the fuselage are used. In the AUTO position, automatic sampling of signal strength is done by the individual pieces of equipment and the antenna receiving the stronger signal is automatically selected. In the LOWER position the antennas on the bottom of the fuselage are used for transmission and reception. The IFF will sometimes cause noise in the LF/ADF receiver because of their respective antenna locations and the automatic switching of the IFF antennas. This noise can be eliminated by selecting the LOWER position for the IFF antenna. Each system independently powers and controls its own antenna selector switch.

INTERCOMMUNICATION SYSTEM AN/AIC-18

The intercommunication system provides: communication within the aircraft with or without the use of microphone buttons; communication beyond the aircraft by integration with its radio equipment; monitoring of received signals either individually or simultaneously; and a call facility which permits transmission of urgent communications to both headsets regardless of individual control panel switch-volumes setting. The control panel (figure 1-27) for both pilots is located on the side panels (17, figure 1-3; 4, figure 1-4). The system acts as a master control for the associated communication and navigation equipment. The system is powered by the 28 volt dc bus. The control panel does not contain an on-off switch; therefore, when dc power is turned on and the interphone circuit breaker is pushed in, the system is on. Each panel has seven separate combination monitor switch-volume controls (4, figure 1-27) which enable the pilots to monitor and individual listening level adjustment of seven audio lines. A six position rotary selector switch (2, figure 1-27) enables transmission over the interphone line or operation and modulation of five radio transmitters. The selector switch also enables audio monitoring and side tone from the associated receiver. When the selector switch is placed in the other positions for a selected transmitter and the mike button (3, figure 1-6), is pressed, the selected transmitter will operate and communications beyond the aircraft will be possible. The front panel also contains a VOL control (3, figure 1-27) to adjust the volume to the associated headphones, a HOT MIC switch (5, figure 1-27), and a CALL button (1, figure 1-27) for emergency call operations. The other pilot is contacted simultaneously regardless of his rotary selector switch position or the position of any of his switch volume controls. Normal intercommunication between the pilot and copilot is provided when their HOT MIC switch is pulled up and

UHF COMMAND RADIO CONTROL PANEL





1. TONE BUTTON
2. FUNCTION CONTROL SWITCH
3. CHANNEL FREQUENCY CARD
4. CHANNEL SELECTOR KNOB
5. VOLUME CONTROL KNOB (INOPERATIVE)
6. MODE CONTROL SWITCH
7. MANUAL FREQUENCY SELECTOR KNOB

Figure 1-28

placed in the ON position and turned to adjust the volume to desired level, the microphone is open for intercommunication.

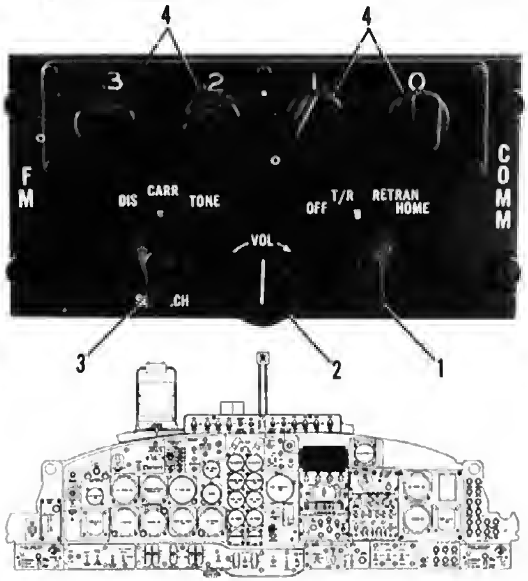
Intercommunication Operation

1. HOT MIC switch - Pull up and adjust as desired.
2. Rotary selector switch - Place on desired transmitter.
3. Volume control knob - Adjust as desired.
4. Monitor receivers - Pull ON-OFF switches up and adjust as desired.

UHF COMMAND RADIO - AN/ARC-133

An AN/ARC-133 command radio set has a line-of-sight reception and provides voice transmission and reception of 1750 frequencies in the range of 225.0 to 399.9 megahertz. The control panel (figure 1-28) for the set is on the stationary instrument panel and permits selection of any of 20 frequencies which can be preset in any order. In addition, an operating frequency can be set up manually without disturbing any of the preset frequencies. The set uses two receivers, a main and a guard receiver. The guard receiver is set and fixed to receive frequency 243.0 megahertz. The functions of the set are selected by the four-position function control switch (2, figure 1-28). The switch, when moved from the OFF position, connects 28 volt dc power from the 28 volt dc bus to the set. When the switch is in the MAIN position, the transmitter and receiver are operative on the same selected main frequency. The BOTH position allows transmission and reception on the main selected channels and simultaneous reception on the guard channel. The ADF position of the switch integrates the ARA-50 direction finder with the AN/ARC-133 frequency selected and provides automatic direction finder functions. Bearing information to the station is displayed on the bearing-distance-heading indicator (ID-663) No. 1 needle. The auxiliary guard receiver is inoperative in this position. When the selector switch on the AN/ARC-133 control panel is in any position other than OFF the ARA-50 system is automatically put in the stand-by condition. The tone button (1, figure 1-28), marked TONE, is adjacent to the function control switch. A mode control switch (6, figure 1-28), is used to select the desired operating mode. The MANUAL position of the switch permits any desired frequency within the operating range of the set to be manually selected by the manual frequency selector knobs (7, figure 1-28). The GUARD position selects the fixed guard frequency for the main receiver and transmitter, and PRESET is used to allow selection of any of the 20 preset frequencies. When the mode control switch is at PRESET, subsequent movement of the cahnnel selector knob changes the frequency to the desired preset channel. A numerical indication of the selected channel appears in a window above the channel selector knob. A record of the frequencies that have been preset and assigned to the 20 channels can be noted on a channel frequency card (3, figure 1-28). The preset frequencies can be changed in flight if necessary. Audio volume is adjusted by the volume control knob located on the ACI-18 control panel.

VHF/FM COMMUNATIONS CONTROL PANEL



1. MODE SELECTOR SWITCH
2. VOLUME CONTROL KNOB (INOPERATIVE)
3. SQUELCH CONTROL KNOB
4. FREQUENCY SELECTOR KNOBS

Figure 1-29

Note

No transmission will be made on emergency (distress) frequency channels except for emergency purposes.

Operation of UHF Command Radio - AN/ARC-133

1. Select PRESET position with the mode control switch.
2. Rotate functton control switch to BOTH position and allow approximately one minute to warm-up main and guard receiver units.
3. With channel selector knob, select the desired channel after warm-up. Set is now ready for use.
4. Adjust volume control for desired audto level.
5. For manual selection of a frequency that is not included in the preset channels, set mode control switch to MANUAL. Turn the four manual frequency selector knobs at the top of the panel until the numerals indicating the desired frequency appear in the windows. The function control switch must be at MAIN or BOTH for manual frequency selection. Thts procedure places the set in receive condition.

Note

- The microphone button should be released before changing transmitter frequency. Approximately four seconds should elapse before transmission begtns on a new frequency.
- If a stuck mike button is suspected, proceed as follows. Turn the HOT MIC SWITCH - OFF. If you can transmit over the interphone without depressing the mike button, you have a stuck button. If this condition exists, turn radio OFF if on the ground. If airborne, turn the rotary switch to a blank position. To transmit, turn rotary selector switch to desired transmitter and then back to a blank position when transmission is complete.
- If continuous channelization occurs, select another channel. If channelization continues, place the function switch to the OFF position and allow a 30 second cooling period before turning the set to the BOTH position.
- Do not attempt to tune the receiver to any frequency below 225.0 megahertz, as the radio will not operate in this range. If a frequency is set manually below 225.0 megahertz, continuous operation of the channeling drive motor results.

6. To obtain transmission and reception of the guard frequency, move mode control switch to GUARD.
7. To obtain direction finding information move function control switch to ADF. Read information on the bearing-distance-heading indicator (ID-663), No. 1 needle.
8. To turn off receiver-transmitter, move function control switch to OFF.

VHF/FM COMMUNITION SYSTEM

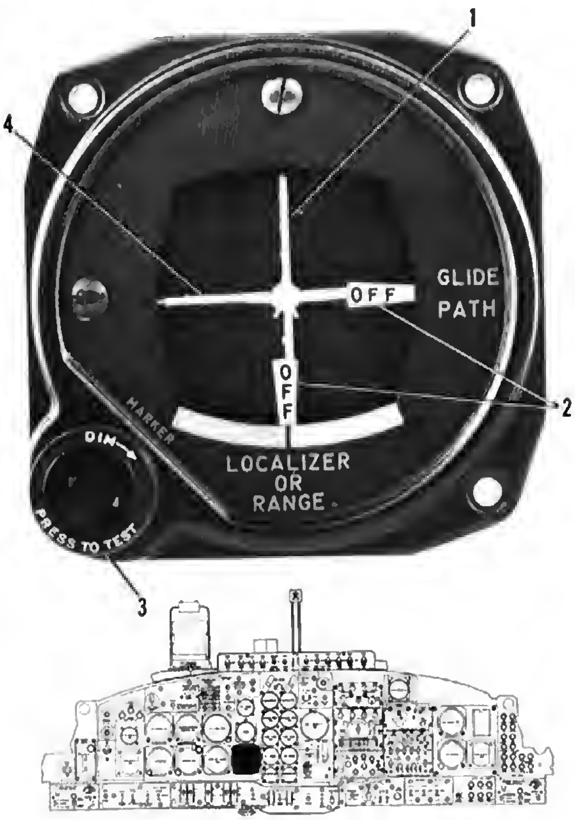
The FM 622 communication system is installed for VHF/FM communication. The receiver is electrically tuned and crystal controlled and covers the frequency range of 30 to 76 megahertz in 50 kilohertz steps to provide a total of 920 channels. Two modes of operation are available; transmit and receive and home. The system receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

VHF/FM Communications Control Panel

The VHF/FM communications control panel (figure 1-29) on the instrument panel, tncorporates a mode selector switch (1, figure 1-29), frequency indicator windows, a volume control knob (2, figure 1-29), a squelch control switch (3, figure 1-29), and four frequency selector knobs. The mode selector switch

COURSE INDICATOR

ID-48



1. COURSE INDICATOR
2. WARNING FLAGS
3. MARKER LIGHT
4. GLIDE PATH INDICATOR

Figure 1-30

(1, figure 1-29) has four positions, OFF, T/R, RETRAN and HOME. In the OFF position power to the system is off. The T/R position is the push to talk position. When the mike button on the throttle is depressed normal communications may be accomplished. The RETRAN position is inoperative in this installation. The HOME position activates the system with the AN/ARA-56 FM Homing, and activates the indication cause needle of the ID-48 (figure 1-30) providing homing capabilities. The volume control on the ACI-18 adjusts the audio output level of the radio set. The squelch control (3, figure 1-29) is a three position switch. In the DIS position the quelch circuits are disabled and are not usable in the normal operation. In the CARR position or normal operating position the squelch circuits operate normally in the presence of any carrier. The TONE position is inoperative. The frequency selector knob (4, figure 1-29) are used to select the megahertz digits of the desired operating frequency. The windows above the knobs display the selected and operating frequency of the radio set. Any frequency from 30 to 75.95 MH_z may be selected.

Operation of the VHF/FM Communication System

1. Set the mode control to T/R - Allow equipment to warm-up.
2. Set squelch control to CARR.
3. Select desired frequency.
4. Adjust volume control for comfortable listening level (ACI-18).
5. Microphone switch - Depress to transmit - Release to receive.
6. Turn the mode control to OFF - to turn the radio off.

Operation of the VHF/FM Homing System

1. Set the mode control to HOME. Allow equipment to warm-up.
2. Set the squelch control to CARR.
3. Select desired frequency. Any signal within the frequency range of the radio can be used for homing if it is strong enough as indicated by the course needle of the ID-48 indicator (figure 1-30).
4. Fly the aircraft toward the homing station by heading in the direction that causes the course needle to center. To solve ambiguity, after turning toward the needle, if the needle centers flight is toward the station. If the needle continues to move away flight is away from the station.
5. Over the station will be indicated by a swinging motion of the needle then a constant setting.
6. Turn the mode switch to OFF to turn the radio off.

SECURE VOICE COMMUNICATIONS PANEL

Information for the KY-28 Secure Voice panel will be provided at a later date.

IDENTIFICATION TRANSPONDER - AN/APX-64

The AN/APX-64 identification transponder set provides automatic selective identification of the aircraft in which it is installed, when properly challenged by surface or airborne radar sets. The set can also identify the aircraft in which it is installed as a friendly aircraft within a group of specific friendly aircraft. Supplementary purposes are to provide momentary identification of position upon request and to transmit a specially coded response to indicate an emergency. In operation, the AN/APX-64 set receives coded interrogation signals and transmits coded reply signals to the source of the challenging signals where the reply codes are displayed, together with associated radar information on the radar screen. When a radar target is accompanied by a proper reply code from the IFF set, the target is considered friendly. Five modes of operation are provided for response to interrogation signals: Mode 1, Mode 2, Mode 3/A, Mode C and Mode 4, which are used for selective, personal, traffic, altitude,

KY-28 SECURE VOICE

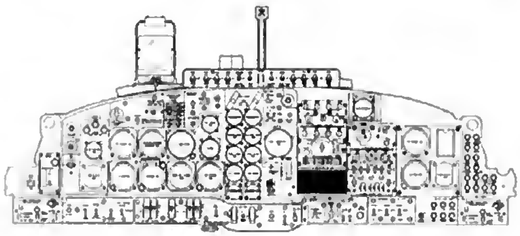


Figure 1-31

and identification respectively. The IFF set provides for two methods of reply coding: Mark X and Mark X SIF. Internal selector switches (set up by ground personnel only) are provided to permit the IFF set to be operated in the Mark X or Mark X SIF configuration. The Mark X configuration provides for use of the IFF (transponder) control portion only, and selection of reply coding is limited to the one code reply combination preset into the equipment. When using the Mark X SIF configuration, the SIF (selective identification feature) control portion of the panel is used in conjunction with the IFF control of the panel, providing for selection of the reply coding through the many code combinations available with the SIF control portion of the panel. Normal power to the AN/APX-64 system is provided from the ac and dc buses.

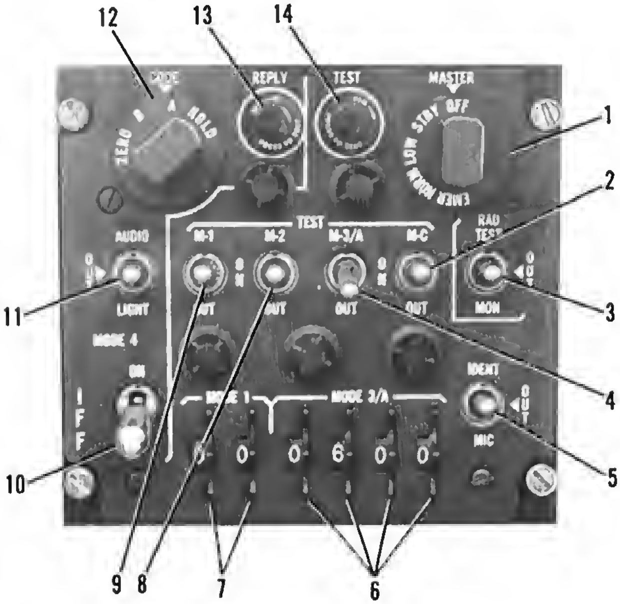
Identification Transponder Control Panel

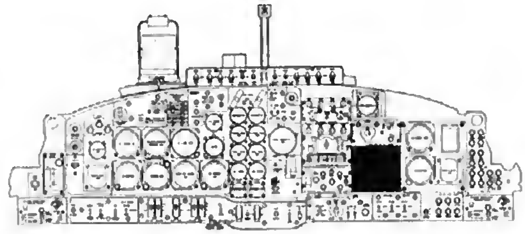
The identification transponder control panel (figure 1-32) is provided for cockpit control of the identification transponder and is located on the radio control panel portion of the stationary instrument panel of the forward cockpit. The panel is easily available to both the pilot and copilot. The IFF/SIF control panel contains five mode switches, an I/P (identification of position) switch (5, figure 1-32), and a five position master switch (1, figure 1-32) with positions of OFF, STBY, LOW, NORM, and EMER. A four position code switch (12, figure 1-32) for Mode 4, with positions of HOLD, A, B, and ZERO, a Mode 4 AUDIO and LIGHT switch, (11, figure 1-32) and a RAD TEST and MON switch (3, figure 1-32). Two lights are on the face of the panel, one is the Mode 4 reply light and the other is the test light for Mode 1, 2, 3/A or C. The Mode 4 and Mode C portion of the transponder are inoperative.

The five position master switch (1, figure 1-32) turns the transponder on and off, selects the desired receiver sensitivity, and provides for emergency operation. In the OFF position the system is inoperative. In the STBY position the transponder is placed in a warm-up standby condition. Rotating the switch on to LOW places the transponder in operation at partial sensitivity and replies only in the presence of strong interrogation.

In the NORM position the system operates at full sensitivity which provides maximum performance. In the EMER position (the knob must be pulled out before it can be turned to EMER) the system causes automatic transmission of emergency reply signals to all modes of interrogation with special coded signals to indicate an emergency. The four mode selection switches (6, 7, 8, 9, figure 1-32) in the center of the transponder panel are for the selection of Mode 1, 2, 3/A, or C. Each switch has an OUT, ON, and TEST position. When the selected switch is placed in the ON position the transponder will reply to that selected interrogation from ground or airborne radar. In normal operation only one mode is selected from 1, 2, 3/A. Mode C is altitude reporting and may be selected as desired or when requested. In the spring-loaded TEST position the transponder will locally interrogate and reply the mode selected and measure the characteristics of the reply. If the reply is satisfactory the TEST light will illuminate and the switch may be released, and it will return to the ON position. In the OFF position, reply capabilities are disabled and the transponder will not reply to that interrogation. The INDENT-MIC switch (5, figure 1-32) has three positions IDENT, OUT and MIC and is spring-loaded from the IDENT to the OUT position. The IDENT position when momentarily actuated initiates identification reply operation for approximately 30 seconds. The MIC position is inoperative. In the OUT position the identification reply from the transponder is disabled. The MODE 1 (7, figure 1-32) and MODE 3/A (4, figure 1-32) select switches or wheels are located at the bottom of the control face. This SIF (selective identification feature) allows selection and indication of a two-digit reply code for Mode 1 and a four-digit reply code for Mode 3/A. The code selection for Mode 2 is preset in the transponder on the ground. The Mode 4, ON and OUT switch (10, figure 1-32) on the left side of the panel enables the transponder to decode Mode 4 interrogations in the ON position and disables Mode 4 decode when in the OUT position. The switch is designed to prevent accidental actuation to the OUT position.

IDENTIFICATION TRANSPONDER CONTROL PANEL





1. MASTER CONTROL SWITCH
2. MODE C SELECT SWITCH
3. RAD TEST MONITOR SWITCH
4. MODE 3/A SELECT SWITCH
5. IDENTIFICATION SWITCH
6. MODE 3/A CODE SELECT SWITCHES
7. MODE 1 CODE SELECT SWITCHES
8. MODE 2 SELECT SWITCH
9. MODE 1 SELECT SWITCH
10. MODE 4 ON-OUT SWITCH
11. MODE 4 AUDIO-LIGHT SWITCH
12. MODE 4 CODE SWITCH
13. MODE 4 REPLY LIGHT
14. TEST LIGHT

Figure 1-32

The Mode 4 AUDIO and LIGHT switch (11, figure 1-32) is a three position switch. In the AUDIO position an aural tone and REPLY light monitoring of a valid Mode 4 interrogation and reply will be indicated with each interrogation and reply. In the LIGHT position only the REPLY light monitoring will function. The MODE 4 control switch (10, figure 1-32) in the upper left-hand corner of the panel, is a four position switch. HOLD is designed to spring return to A position when the control is released. The knob must be pulled outward before it can be turned to the ZERO position, so as to prevent inadvertent placement into this position. The functions of this control are operationally classified. The RAD TEST and MON switch (3, figure 1-32) is a three position toggle switch that is spring-loaded from the RAD TEST position to the OUT position. Holding the switch in the RAD TEST position enables an appropriately equipped transponder to reply to TEST mode interrogations from an AN/UPM-92 or similar equipment. Other functions of this switch position are classified. Placing the switch in the MON position enables the monitor circuits of test set TS-1843/APX. The TEST light will come on whenever replies are transmitted in response to interrogations in any selected SIF code. The TEST light and REPLY light are Press-to-Test lights and may be dimmed for use under low light conditions, and brightened for high light conditions.

Operation of AN/ APX-64 Transponder

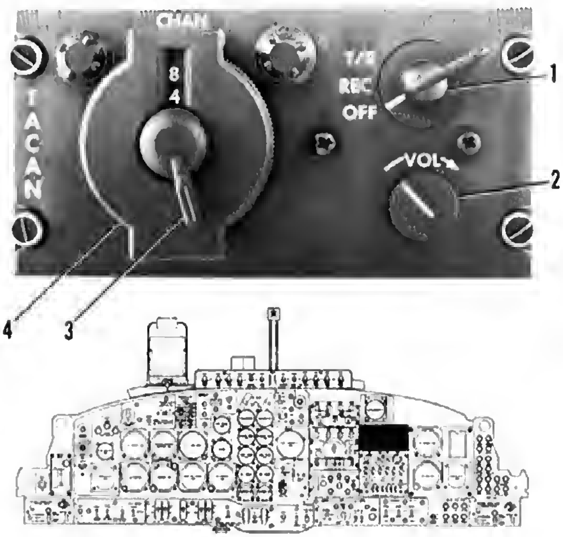
1. Rotate the master switch to STBY to warm-up and maintain equipment inoperative but ready for instant use. Two minutes are required for warm up.
2. Rotate the master switch to NORM to place the transponder into operation.

Note

The LOW position of the master control switch should not be used except upon proper authorization or request from a controlling agency.

3. Set the desired Mode switch to ON. Mode 1, 2, or 3/A.
4. Set the Mode 1 or Mode 3/A code selector switches on the SIF as directed.
5. Set the RAD TEST and MON switch to MON.
6. To test the transponder hold the desired Mode switch to test until the TEST light illuminates, indicating proper operation of that mode. Release and the switch will return to OFF.
7. For emergency operation pull the master control out and rotate to EMER position, so that the transponder will automatically transmit a special coded distress signal in response to interrogation. If time and convenience are available rotate MODE 3/A to 7700.
8. Placing the master control to OFF turns OFF all electrical power to the set.

TACAN CONTROL PANEL



1. FUNCTION SWITCH
2. VOLUME CONTROL KNOB
3. 0 TO 9 CHANNEL SELECTOR SWITCH
4. 0 TO 12 CHANNEL SELECTOR SWITCH

Figure 1-33

SST-181X X-BAND RADAR TRANSPONDER

The SST-181X pulse type radar tracking aid is to extend the tracking range of such precision tracking radar as the M33, AN/APN-59, AN/MPQ-29, AN/TSP-31, AN/SPS-23, and similar X-Band tracking and instrumentation radars. To accomplish this function, the SST-181X receives either coded or single pulse interrogation and transmits a single pulse reply in the same frequency band. The switch that turns on power to the SST-181X is located (25, figure 1-7) to the right of the switch panel and is a two position OFF-ON switch.

TACTICAL AIR NAVIGATION SYSTEM (TACAN) AN/ARN-65

The TACAN (tactical air navigation) system is capable of giving bearing and slant distance to a surface beacon. The ARN-65 transmits an interrogation signal from the aircraft to the ground surface station beacon, which receives the same signal and retransmits it back to the aircraft. The equipment in the aircraft accepts only the answer to its interrogation signal. By an electronic measurement of the elapsed time, the distance information is computed and shown on the distance indicator. This distance figure is given as slant distance in nautical miles from the aircraft down to the surface beacon. The surface beacon also transmits a Morse code identification signal every 38 seconds. The AN/ARN-65 has a line-of-sight range of about 195 miles.

Tactical Air Navigation System (TACAN) AN/ARN-65 Control Panel

Function Switch

When the function switch (1, figure 1-33) is at T/R, the AN/ARN-65 starts transmitting an interrogation signal to the surface beacon for distance information and also receives bearing information from the surface beacon. Moving the function switch to REC stops the transmitting of the interrogation signal and only bearing information is received from the surface beacon. The distance indicator is inoperative and a red bar drops across the figures. Power for the switch is supplied by the secondary bus and single phase ac bus.

Channel Selector Switch

The two channel selector switches (3, 4, figure 1-33) permits selection of any of 126 channels for air-to-ground transmissions. These channels cover 1025 MH_Z to 1150 MH_Z with a one MH_Z separation. Each switch is a circular knob. The outer knob selects numbers from 0 to 12; the inner knob selects numbers from 0 to 9; thus any combination of channels up to 126 can be set up in the channel window. Power for the channel selector switches is from the single phase ac bus.

Note

Allow about 12 seconds after channel selection for the bearing indicator and the distance indicator to correctly indicate the new information.

Volume Control Knob

The volume control knob (2, figure 1-33) is inoperative. The volume is adjusted on the ACI-18.

OPERATION OF AN/ARN-65 (TACAN)

To operate the AN/ARN-65 radio, proceed as follows:

1. Rotate channel selector switch to surface beacon desired.
2. Move function switch to either REC or T/R and allow about 2 minutes for warm-up, or until bearing indicator stops spinning.

Note

A false lock on may occur momentarily; however, the bearing needle will release and stabilize on the magnetic bearing of the surface beacon.

L F NAVIGATION CONTROL PANEL

1. TUNING DIAL
2. BAND SELECTOR SWITCH
3. FREQUENCY DIAL
4. VOLUME
5. FUNCTION SELECTOR SWITCH
6. LOOP CONTROL SWITCH
7. BEAT FREQUENCY OCILLATOR SWITCH
8. TUNING METER

Figure 1-34

3. Adjust the volume as desired.
4. Verify station identification.
5. Observe course deviation indicator for disappearance of alarm flag.
6. To home on surface beacon:

a. Turn aircraft until J-2 directional indicator reads the same as the No. 2 pointer and compass card on the bearing-distance-heading indicator (ID-663) (figure 1-35).

b. Rotate "SET" knob on course indicator to select desired radial (ID-351B) (figure 1-36).

c. Read slant range on distance indicator (3, figure 1-35).

Note

If the function switch is at T/R, the distance indicator will show a reduction in mileage as the aircraft approaches the surface beacon, and an increase in mileage as the aircraft flies away from the beacon.

7. To turn equipment off, move function switch to OFF.

Note

After the AN/ARN-65 is turned off, the No. 2 pointer rotates freely.

LF NAVIGATION SYSTEM AN/ARN-83

The AN/ARN-83 Automatic Direction Finder is provided for LF Navigation. The receiver may be used as a range receiver or direction finder within the range of 190 to 1750 kilohertz. The frequency range is covered in three separate bands which may be selected on the LF navigation control panel (2, figure 1-34). Operation of the direction finder loop is automatic or can be manually operated by controlling the loop switch (6, figure 1-34). The Automatic Direction Finder receives its power from the 28 volt dc bus and is protected by a circuit breaker (figure 1-11).

LF NAVIGATION CONTROL PANEL

The LF navigation control panel (figure 1-34) has a GAIN control knob (4, figure 1-34), a frequency dial (3, figure 1-34), a function selector switch (5, figure 1-34) labeled OFF, ADF, ANT, and LOOP. This switch selects the type of operation desired of the receiver. In the ADF position, the receiver operates as an automatic direction finder. In the ANT position, the system operates as an LF receiver and in the LOOP position, the system operates as a direction finder when the LOOP switch (6, figure 1-34) is actuated either to the left or right. The OFF position turns the power off to the system. The LOOP switch (6, figure 1-34) is a momentary switch and may be actuated to either the left or right of the center position. The loop may be rotated away from a directional indicator to test operation of the loop or to set the loop to a desired azimuth depending upon the setting of the function selector switch. The band selector switch (2, figure 1-34) selects the desired frequency range. As the switch is changed from one frequency to another, the frequency range will appear on the frequency dial. The tuning dial (1, figure 1-34) is used to select a particular frequency on any of the three bands. The tuning meter (8, figure 1-34) will indicate the strength of the received station and is used to tune maximum signal strength. The beat frequency oscillator (7, figure 1-34) may be used to tune in a station properly even though the station is too weak to hear intelligibly or to operate the tuning meter.

Note

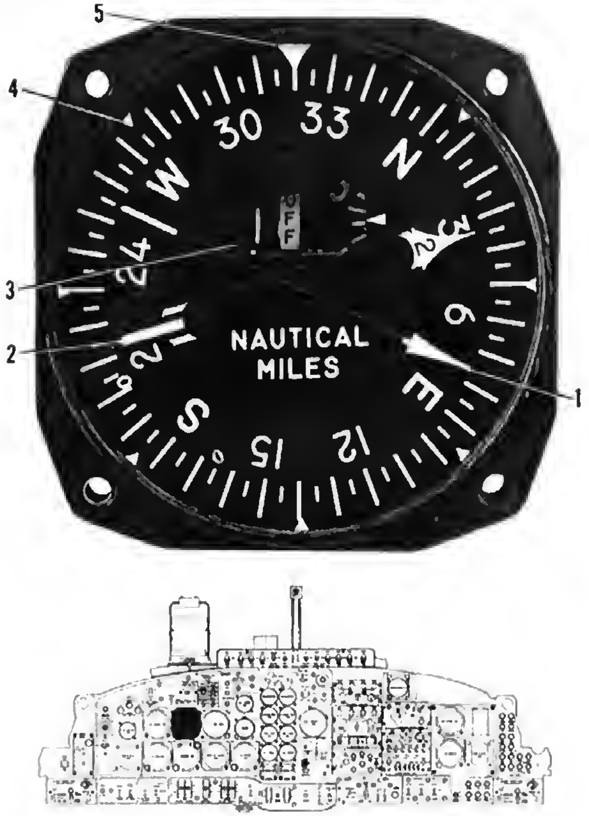
With the IFF antenna in close proximity to the LF/ADF antenna noise of sufficeint strength to cause undesirable operation can result. To eliminate the noise select the LOWER, IFF antenna.

OPERATION OF LF NAVIGATION SYSTEM AN/ARN-83

1. Function selector switch - ANT position.
2. Gain control knob - Inoperative.
3. Band selector switch - Desired frequency range.
4. Tuning knob - Desired station frequency.
5. Volume control knob (AIC-18) - Readjusts for comfortable level.

BEARING, DISTANCE, HEADING INDICATOR

TACAN ID-663



1. NO. 1 NEEDLE
2. NO. 2 NEEDLE
3. DISTANCE INDICATOR
4. COMPASS CARD
5. HEADING INDEX

Figure 1-35

6. Function selector switch - OFF, (to turn receiver off).

As an Automatic Direction Finder

1. Function selector switch - ANT position.
2. Gain control knob - Inoperative.
3. Band selector switch - Desired frequency range.
4. Tuning knob - Desired station frequency.
5. Function selector switch - ADF position. Adjust tuning knob for maximum deflections on tuning meter.
6. Volume control knob (ACI-18) - Readjust for comfortable level.
7. Radio Magnetic compass indicator - Read magnetic reading.
8. Loop switch - Check operation of ADF on station by operating loop switch to left or right. Indicator hand should return to same bearing when the switch is released. If the indicator hand does not return to the same bearing ±3°, the signal should not be used for ADF navigation.
9. Function selector switch - OFF, (to turn receiver off).

As a Manually Controlled Direction Finder

1. Function selector switch - ANT position.
2. Gain control knob - Inoperative.
3. Band selector switch - Desired frequency range.
4. Tuning knob - Desired station frequency.
5. Function selector switch - LOOP position.
6. BFO switch - ON.
7. LOOP switch - Adjust, left or right, for null location.
8. Gain control knob - Readjust for desired null width.
9. Function selector switch - OFF, (to turn receiver off).

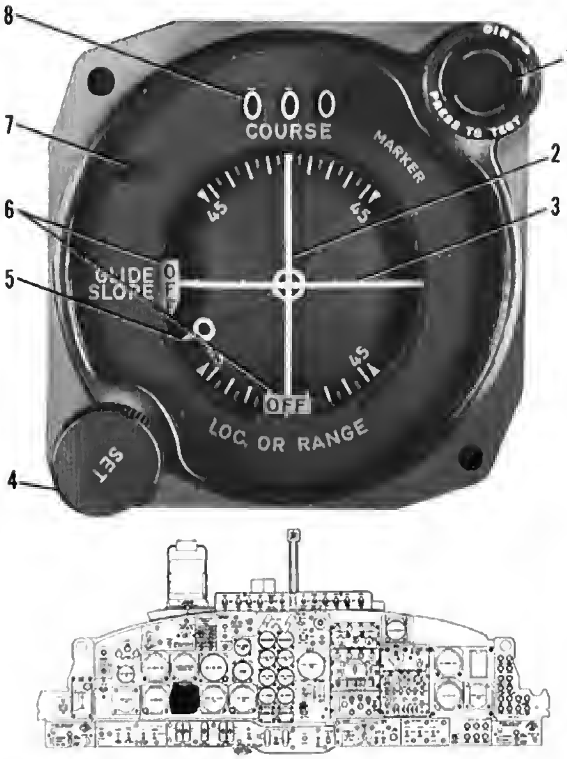
BEARING-DISTANCE-HEADING INDICATOR (ID-663)

The bearing indicator (figure 1-35) indicates the bearing to the surface beacon from the aircraft position. The No. 2 pointer (2, figure 1-35) provides TACAN bearing information which is read directly from the indicator as magnetic bearing to the beacon. The indicator operates when the function switch is at either REC, T/R. If the signal is lost or interfered with, such as a steep bank which might place the antenna away from the surface beacon, a memory circuit in the receiver maintains the last bearing received for about 3 seconds. If the signal is still disrupted after the time limit, the bearing indicator pointer spins counterclockwise until the signal is picked up again. During a channel change or when the equipment is first turned on, the bearing pointer may falsely lock-on momentarily to a bearing, but as the correct data is fed into the system, the pointer will swing to the correct bearing. Therefore, wait a few seconds after a lock-on before relying on the bearing indicated.

The distance indicator (3, figure 1-35) shows in nautical miles the slant range from the aircraft to the surface beacon by means of figures displayed in a small window in the center of the instrument. The indicator operates only when the function switch is at T/R. When the indicator is inoperative or when the channel is being changed, a red flag drops down and covers the figures. If the return signal from the surface beacon is lost because of interference or because the aircraft is beyond the 195 mile range of the equipment, a memory circuit retains for about 10 seconds the last distance before the interruption; then the red flag drops across the figures. When the aircraft is back within range, the distance indicator corrects itself and the red flag disappears automatically. There will be a momentary false indication when the equipment is first turned on or when changing channels. However, wait a few seconds to ensure that the indication can be relied upon.

COURSE INDICATOR

ID-351



1. MARKER BEACON LIGHT. (INOPERATIVE)
2. COURSE DEVIATION INDICATOR.
3. GLIDE SLOPE INDICATOR. (INOPERATIVE)
4. COURSE SET KNOB.
5. HEADING POINTER.
6. ALARM FLAGS.
7. TO-FROM INDICATOR.
8. COURSE INDICATOR.

Figure 1-36

Note

An inherent error exists in the TACAN system and may appear as a false bearing indication of plus or minus 40 degrees or multiples of 40. Whenever possible, TACAN bearing indications should be confirmed with known bearings. TACAN instrument departures and penetrations should be monitored by ground radar to verify TACAN bearing information whenever possible. If false lock on is suspected, change to another frequency and return to original frequency to regain positive lock on.

COURSE INDICATOR (ID-351B)

Signals are directed into the course indicator (ID-351B) (figure 1-36) from the TACAN receiver to operate the course deviation indicator (CDI) (2, figure 1-36) for course guidance. A heading pointer (5, figure 1-36) and heading deviation scale show the heading of the aircraft to the right or left of the selected course both to and from the selected station. The course deviation indicator has a maximum deflection of about 10 degrees either side of the course centerline. A course set knob (4, figure 1-36), on the lower left corner of the instrument is used to select a desired course, the magnetic value of which appears in a window (8, figure 1-36) at the top of the instrument. The indicator in the upper left corner (7, figure 1-36) of the instrument displays TO and FROM indication, which signifies whether the selected course, if flown leads inbound to the station tuned in or outbound in relation to the aircraft position. The instrument also has a glide slope indicator (3, figure 1-36) and marker beacon light (1, figure 1-36) both of which are not used on this aircraft. The indicator is provided with red alarm flags (6, figure 1-36) for both the course deviation indicator and the glide indicator. The alarm flag for the course deviation indicator becomes visible at any time a received signal is unreliable, and when the equipment is shut off, either intentionally or because of electrical power failure. The alarm flag for the glide slope indicator is nonfunctional on this aircraft and is visible at all times. The course indicator receives its power from the 28 volt dc bus and 115 volt ac three phase bus. Failure of either electrical source will render the course indicator inoperative.

Note

- The course indicator and the bearing-distance-heading indicator operate independently of each other and it is possible to have one operating normally without the other.
- When the TACAN range is transmitting an abnormal or erroneous signal, the station identification does not get transmitted. In this case the receiver may be getting a signal of sufficient strength to keep the alarm flag from showing. Therefore, the indicator is reliable only if the alarm flag is not displayed and the station is being received.

LIGHTING EQUIPMENT

EXTERIOR LIGHTING

Two position lights, four navigation lights, two landing lights, one taxi light, and two anti-collision beacons, provide exterior lighting for both in-flight and ground operation. The position and navigation lights are controlled by a switch in the cockpit which provides a selection of dim and steady or bright and flashing circuits. One white position light is located on the upper center line of the fuselage aft of the canopy and the other on the lower center line of the fuselage; these lights are not on the flashing circuit. One navigation light is located on each wing tip tank, a green light on the right and a red light on the left. The two tail lights, one white and one amber, are located on the tailcone stinger. One landing light is flush mounted on the under side of each wing, aft of the landing gear and the taxi light is mounted in the nose. These lights are controlled by a single selector switch, and the nose gear down lock switch. One red anti-collision beacon is located on the upper surface of the aircraft, aft of the canopy, and the other on the lower surface of the fuselage. The anti-collision beacons are controlled by a switch located on the switch panel. With the switch in the ON position, the anti-collision beacons will be operating to show a rotating red beacon. If the landing gear is down and locked, the landing lights will be operable. If the landing gear is in any other position, except down and locked, the landing lights will not come down and on.

Navigation Light Switch

The position and navigation lights are operated by one switch (3, figure 1-7). The switch has three positions BRIGHT & FLASH, OFF, and DIM & STEADY. In the BRIGHT & FLASH position, the navigation lights will be bright and flashing and the position lights will be bright. In the DIM & STEADY position, the navigation and position lights will be dim and steady. The lights receive their power from the 28 volt dc bus.

Anti-collision Beacon Lights Switch

The anti-collision beacons switch (4, figure 1-7), has two positions: ON and OFF. In the ON position, the two red anti-collision beacons are turned on. The anti-collision beacons receive their power from the 28 volt dc bus.

Note

> The anti-collision beacons switch should be in the OFF position during flight through conditions of reduced visibility when the pilot could experience vertigo as a result of the rotating reflections of the lights against the clouds.

Landing and Taxi Light Switch

The landing and taxi light switch (37, figure 1-5), has LANDING, OFF, and TAXI positions. When the switch is in the LANDING position, the flush-mounted landing light in each wing is extended and automatically turned on, provided the landing gears are down and locked. In the OFF position, the landing lights are retracted flush with the wings and automatically turned off. In the TAXI position, the taxi light in the nose section is turned on. The landing and taxi lights receive their power from the 28 volt dc bus.

INTERIOR LIGHTING

Interior lighting equipment includes two cockpit lights, five secondary instrument lights, individual instrument lights and edge lighting for the switch panel, radio control panels, oxygen regulators, portions of the left instrument panel, lower portion of the stationary instrument panel and the intercommunication control panels located on either side of the cockpit. Intensity for all lighting equipment is controlled by four rheostat switches.

COCKPIT LIGHTS

Primary Flight Instrument Lights Rheostat

The primary flight instrument lights rheostat (13, figure 1-6), controls the intensity of the compass, clock, and all of the flight instruments including the course indicator (ID-351B). The rheostat receives its power from the 28 volt dc bus.

Primary Instrument Lights Rheostat

The primary instrument lights rheostat (14, figure 1-6), controls the intensity for the edge lighting of the switch panel and parts of the left instrument panel and lower portion of the stationary instrument panel, flap position indicator, both oxygen regulators, accelerometer and all the engine and pressure instruments. Power to the rheostat comes from the 28 volt dc bus.

Secondary Instrument Lights Rheostat

The secondary instrument light rheostat (15, figure 1-6) controls the intensity of the five lights located under the glare shield, that illuminate the instrument panel. Power to this rheostat comes from the 28 volt dc bus.

Radio Lights Rheostat

The radio lights rheostat (17, figure 1-2) controls the intensity of the edge lighting for the UHF command radio control panel, TACAN receiver control panel and the intercommunications control panels located on either side of the cockpit. Power for this rheostat is supplied by the 28 volt dc bus and the circuit is protected by the same circuit breaker that protects the primary instrument lights circuit.

CANOPY

A clear plastic shatter resistant canopy covers the entire cockpit area, and can be jettisoned in flight or while the aircraft is on the ground. The canopy is opened or closed electrically by internal or external canopy switches. In the closed position, manually operated canopy downlocks, on each side of the canopy, are engaged to lock the canopy to the closed position. During all normal canopy operations, the downlock handles must be manually pulled aft before the canopy can be raised or lowered electrically; however, a thruster provision in the jettison mechanism unlocks the downlocks automatically during canopy jettisoning. Emergency jettisoning of the canopy is accomplished by pulling up on the ejection seat arming handles, or by pulling the external canopy jettison handle. In the event no electrical power is available to operate the canopy actuator, a mechanical declutch provision allows the canopy to be manually opened or closed from inside or outside of the aircraft. During taxiing operation the canopy should be full open or down and locked.

INTERNAL CANOPY CONTROL SWITCH

The internal canopy control switch (figure 1-37) has two positions, OPEN and CLOSED, and is spring-loaded to the OPEN position. With the canopy closed and locked, moving either canopy downlock handle back to the unlocked position will automatically open the canopy. To close and lock the canopy, this switch must be held in the CLOSED position until the canopy downlock handle is forward and locks the canopy. Travel limit switches within the canopy actuator automatically disengage the actuator motor when travel to the full open or closed position is reached. This switch is deactivated by a microswitch on the canopy downlock handles whenever they are moved forward to the locked position, and by a microswitch on the left main landing gear whenever the landing gear is off of the ground. The switch receives its power directly from the 24 volt dc battery.

CANOPY CONTROL SWITCH

The canopy control switch (figure 1-38) has two positions, EXTERNAL and INTERNAL. The EXTERNAL position disconnects the internal canopy switch from the circuit and allows normal operation of the external switches. The INTERNAL position deactivates the external canopy switches and the canopy will move to the full open position if the canopy is unlocked and battery power is available. This switch must be in the INTERNAL position for all normal operations.

CANOPY DOWNLOCK HANDLES

The canopy downlock handles (1, figure 1-3; 3, figure 1-4) are interconnected to permit manually locking and unlocking of the canopy from either the pilot's or copilot's seat. Moving either handle forward locks the canopy. Before the canopy can be opened or closed normally, the canopy downlock handles must be moved back to the unlocked position.

CANOPY-NOT-LOCKED WARNING LIGHT

The red, canopy-not-locked warning light on the instrument panel (4, figure 1-5) illuminates when the battery switch is ON and the canopy downlock handles are not fully forward. The warning light receives its power from the 28 volt dc bus.

CAUTION

The light will go out whether the canopy is down and locked or not, as long as the handles are in the forward LOCKED position.

EXTERNAL CANOPY SWITCHES

The external, spring-loaded canopy switches (figure 1-38) are used to open and close the canopy. The switches use 28 volt dc power from the battery to operate the canopy actuator motor. Each button must be held IN until canopy travel has reached the desired position.

INTERNAL CANOPY CONTROL

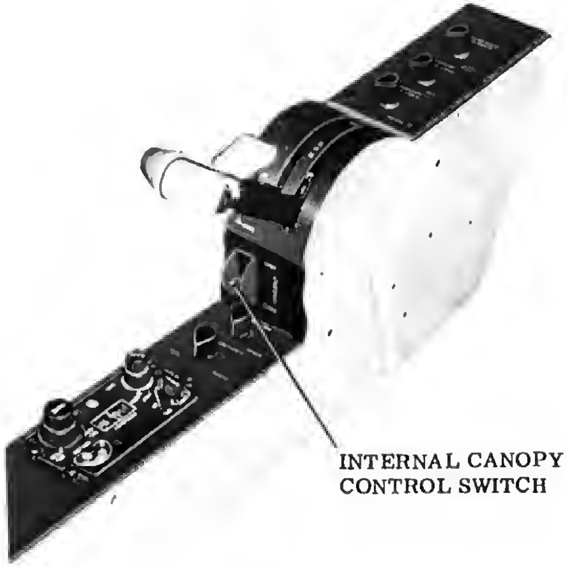


Figure 1-37

EXTERNAL CANOPY CONTROLS

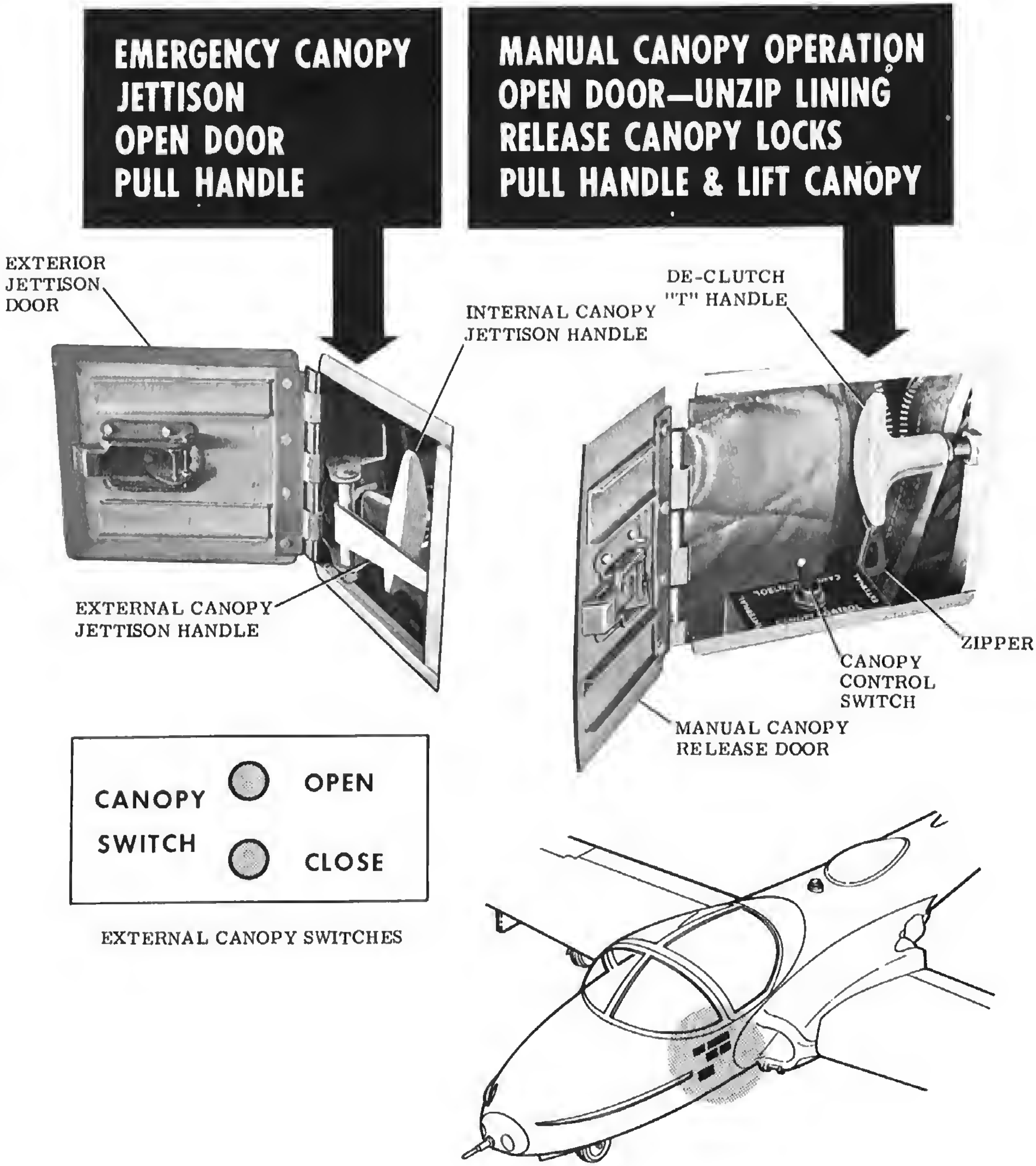


Figure 1-38

CANOPY JETTISON HANDLE

The canopy jettison handle (7, figure 1-3) permits the pilot to jettison the canopy from the cockpit when seat ejection is not contemplated or for a ground crew to jettison the canopy for emergency entrance to the cockpit.

AUXILIARY POWER UNIT (APU) CANOPY SWITCH

The auxiliary power unit (APU) canopy switch in the left nose compartment of the aircraft allows the canopy to be opened or closed using an auxiliary power unit. The switch is a toggle type, spring-loaded from the CANOPY to the APU position. When positioned to CANOPY, the switch directs 28 volt dc power from the auxiliary power unit to the external canopy switches. To raise the canopy using the auxiliary power unit, position the switch to CANOPY, and simultaneously press the external canopy switch marked OPEN. To close the canopy, repeat procedure using external canopy switch marked CLOSE.

CANOPY DE-CLUTCH "T" HANDLE

The canopy de-clutch "T" handle (figure 1-38) is provided for maintenance operation when 28 volt dc power is not available to operate the canopy actuator motor. Opening or closing the canopy can be accomplished manually using the canopy de-clutch "T" handle in the following manner:

1. Open the manual canopy release door.
2. Release downlocks if locked.
3. Pull and hold de-clutch "T" handle located just inside the canopy manual release door and lift canopy.
4. Release de-clutch "T" handle to hold canopy open.
5. To close the canopy, manually hold canopy and pull the de-clutch "T" handle gently lowering canopy until closed.

CAUTION

Due to the weight of the canopy, two crew members, one on each side, are required to open and close the canopy using the canopy de-clutch "T" handle.

RAIN REMOVAL SYSTEM

The rain removal system is a manually operated electrically actuated, in-flight applied, rain repellent system. The system consists of 8 fixed nozzles, a pressurized disposable fluid container, located in the nose with a sight gage, a solenoid valve, time delay and a push button switch located on the instrument panel (11, figure 1-5). When the switch is depressed, the solenoid valve and time delay are activated simultaneously, allowing repellent fluid to be ejected thru the nozzles onto the windshield. At the completion of the time cycle, the timer interrupts power to the solenoid valve, shutting off the supply of the fluid. The system will dispense approximately 5cc of fluid during each application cycle.

The sight gage is used to determine when the fluid container is nearly empty. When the air space appears at the top of the gage, an additional 6 to 8 applications of fluid remain in the container, before servicing becomes necessary. The system receives its power from the 28 volt dc bus.

COCKPIT AIR CONDITIONING, VENTILATION AND DEFROSTING SYSTEM

The air conditioning system utilizes bleed air from the engine compressors to supply air for heating or cooling the cockpit. Bleed air from each engine compressor passes through check valves and manually operated shutoff valves to a modulating valve. The modulating valve diverts a selected amount of air through a heat exchanger and then a refrigeration unit. Bleed air and refrigerated air are then mixed in the mixing muff and pass through a water separator where moisture is condensed from the air. The air enters the cockpit at a preselected temperature through air outlets on the glare shield, on both sides of the cockpit, on each side of the copilot's quadrant and in the area just forward of the feet along each side of the cockpit. The air conditioning system is powered by the 28 volt dc bus and 115 volt ac single-phase bus.

COCKPIT AIR CONDITIONING CONTROLS

Cockpit Air Temperature Control Switch

Temperature of the air admitted to the cockpit is controlled by a four-position cockpit air temperature control switch (4, figure 1-39). Temperature control is maintained automatically when the switch is in the AUTOMATIC position. When the switch is in the OFF position, the automatic control system is inoperative and the modulating valve remains fixed in the position at the time the switch was set to the OFF position. If the automatic control system fails or if desired temperature cannot be obtained with the switch in the AUTOMATIC position, the switch may be held in the HOT or COLD position until the desired temperature of the cockpit air is reached. The switch is spring-loaded to the center OFF position from the HOT or COLD position. The switch receives power from the 28 volt dc bus.

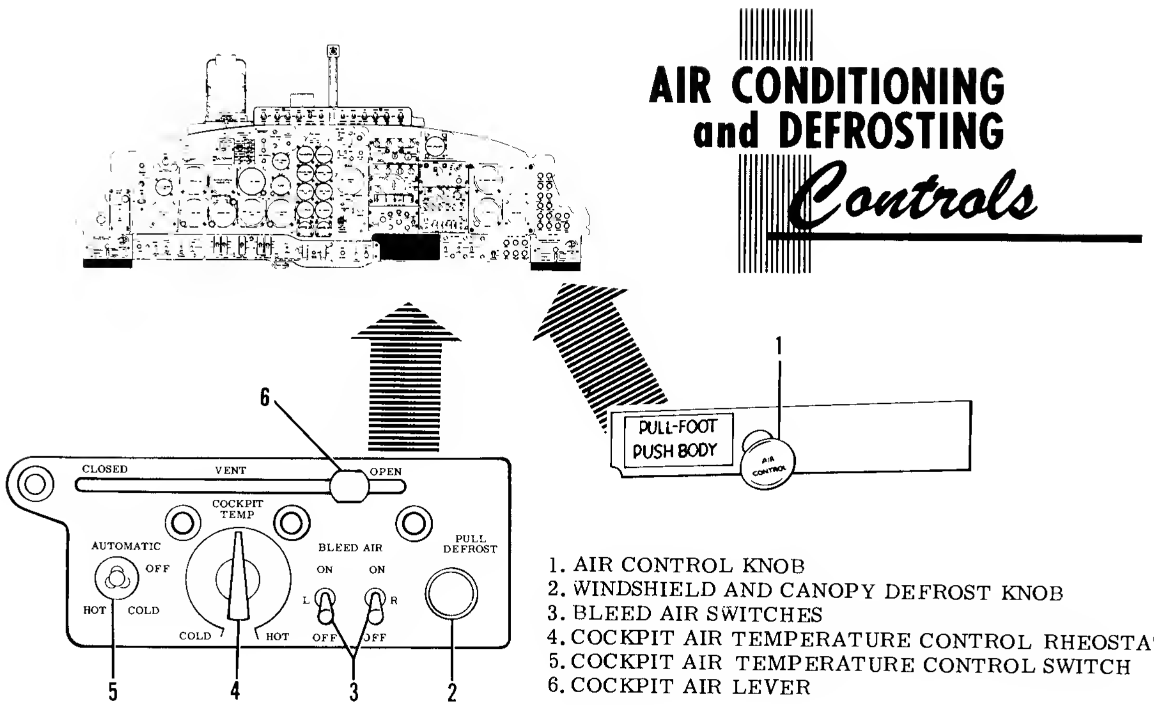
Note

If inverters fail, resulting in complete loss of ac power, the air conditioning system will be inoperative in the AUTOMATIC position and the manual HOT or COLD position must be selected to maintain desired cockpit temperature.

BLEED AIR SWITCHES

Bleed air to the air conditioning system is controlled by two switches (3, figure 1-39), on the air conditioner control panel. These switches are located between

AIR CONDITIONING and DEFROSTING Controls



1. AIR CONTROL KNOB
2. WINDSHIELD AND CANOPY DEFROST KNOB
3. BLEED AIR SWITCHES
4. COCKPIT AIR TEMPERATURE CONTROL RHEOSTAT
5. COCKPIT AIR TEMPERATURE CONTROL SWITCH
6. COCKPIT AIR LEVER

Figure 1-39

the cockpit air temperature control rheostat and the defrost knob. The switches control bleed air from each engine and are labeled R and L for the right and left engine bleed air. The switches are two position ON and OFF. In the ON position the shutoff valve is open allowing bleed air to pass to the air conditioner. In the OFF position the shutoff valve is closed. The bleed air system is powered by the 28 volt dc bus.

COCKPIT AIR TEMPERATURE CONTROL RHEOSTAT

The rheostat (4, figure 1-39), controls cockpit air temperature and functions only when the cockpit air temperature switch is in the AUTOMATIC position and when ac power is available at the cockpit temperature control unit.

COCKPIT VENTILATION

Cockpit ventilation is provided through the ram air intake duct and uses the same outlets as the air conditioner. Cockpit ventilation may be selected any time that air conditioning is not desired or malfunctioning. The temperature of the air will be the same as outside air temperature.

Cockpit Vent Lever

If air conditioning is not desired, positioning the cockpit vent lever (6, figure 1-39) to the OPEN position opens the ram air system, allowing outside air to enter the cockpit through the same air outlets as used by the conditioned air. With the lever in the CLOSED position, ram air is shut off. Both ram air and conditioned air cannot be selected at the same time.

Note

> The cockpit vent lever should be in the CLOSED position during flights in rainy weather and while the aircraft is not in use to prevent the collection of water in the ram air valve.

Air Control Knob

A manually operated air control knob (1, figure 1-39), labeled PUSH-BODY and PULL-FOOT, is located below each oxygen regulator. When either knob is pulled out, it directs conditioned air or ram air to the area just forward of the feet. With the knob pushed in, air is directed to the piccolo tubes. Either knob may be placed in any intermediate position to permit distribution of air from both outlets at the same time.

DEFROSTING SYSTEM

Part of the bleed air from the engines that conditions the cockpit air is also used for windshield and canopy defrosting. The bleed air enters the defrosting sys-

AIR CONDITIONING and

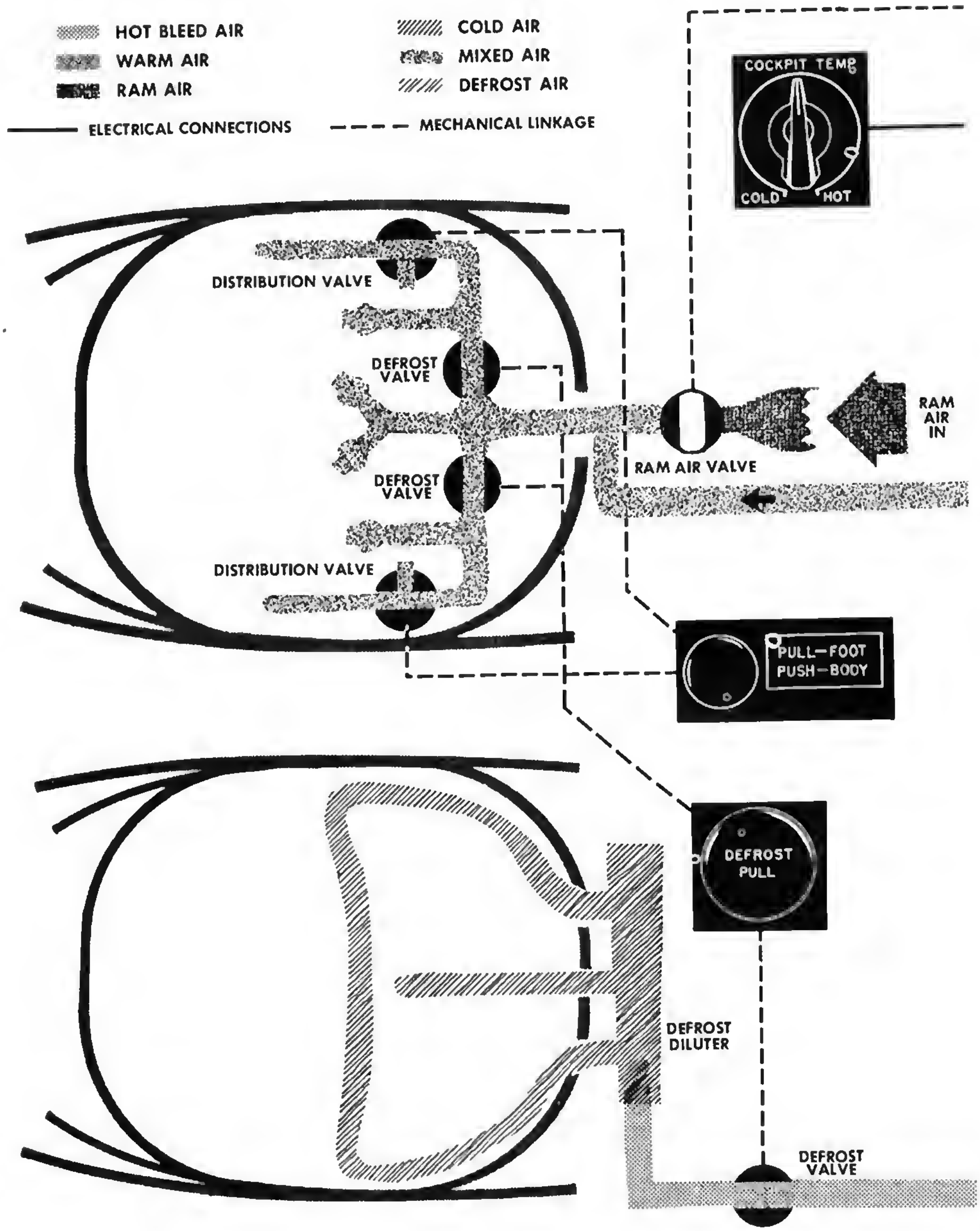


Figure 1-40 (Sheet 1 of 2)

DEFROSTING SYSTEM

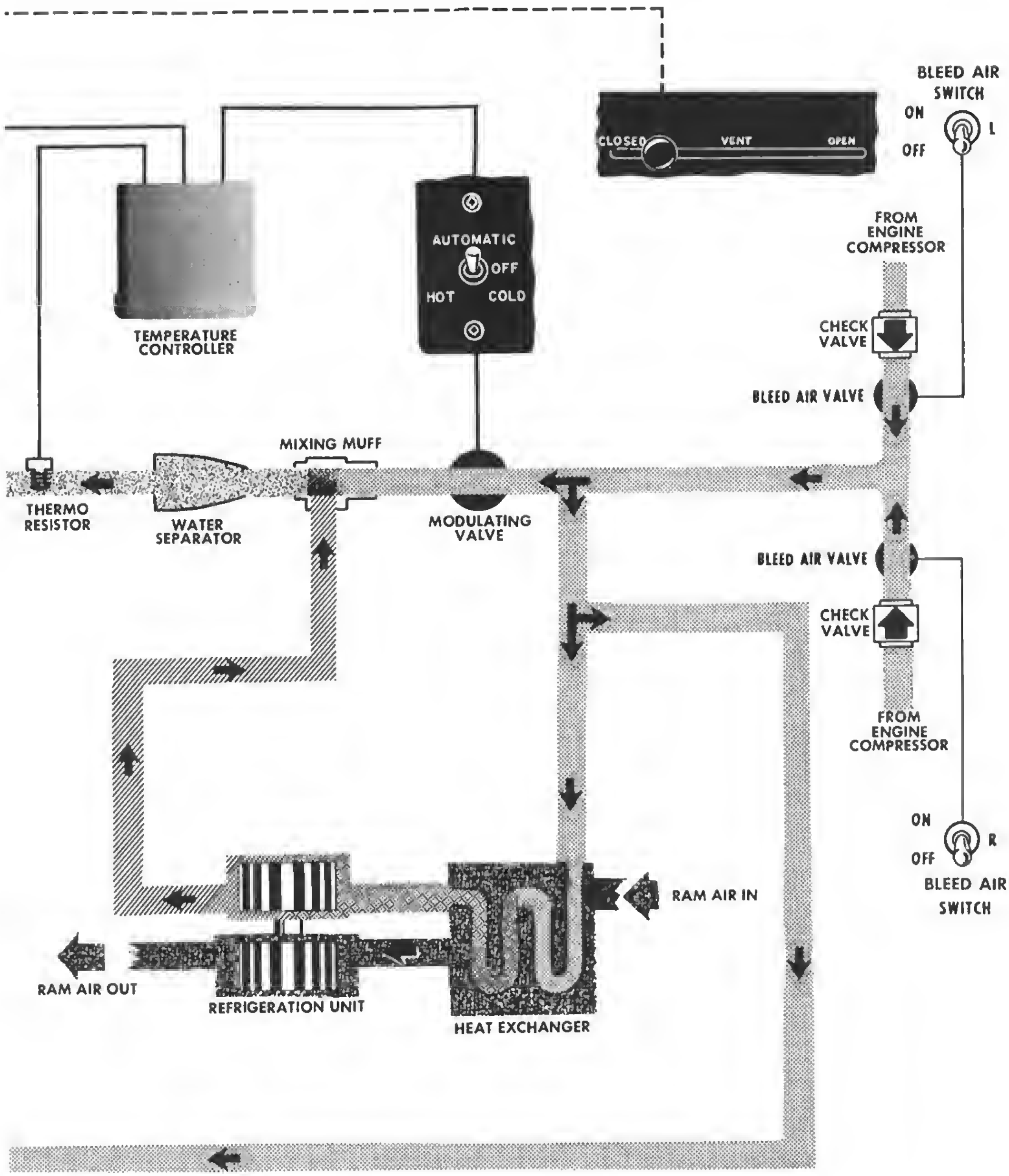


Figure 1-40 (Sheet 2 of 2)

tem through a manually controlled defrost shutoff valve. Cabin air is then mixed with the hot bleed air, and released from outlets along the bottom and center of either side of the windshield and on the forward edge of the canopy.

Windshield and Canopy Defrost Knob

The windshield and canopy defrost knob (2, figure 1-39), is on the lower center portion of the instrument panel to the right of the bleed on switches. The amount of defrosting may be controlled by the forward-aft positioning of the defrost knob pulling the knob out increases defrosting. The air conditioning outlets will increase or decrease flow by the forward-aft positioning of the defrost knob. The outlets on the center console will not be affected by this knob or its positioning.

Note

> The defrosting system should be operated at the highest temperature possible (consistent with the pilot's comfort) during high altitude flight in order to provide sufficient preheating of the windshield and canopy surfaces to preclude the formation of frost or fog during descent.

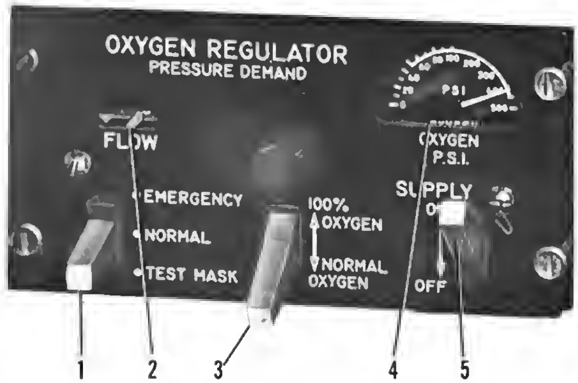
NORMAL OPERATION OF COCKPIT AIR CONDITIONING SYSTEM

1. Bleed air switches - ON.
2. Cockpit air temperature control switch - AUTOMATIC.
3. Cockpit air temperature control rheostat - To desired temperature.
4. Air control knob - To desired position.

GASEOUS OXYGEN SYSTEM

The gaseous oxygen system has two supply cylinders with an original charge pressure of 425 ±25 psi (full) and are located in the forward part of the tailcone. Two type CRU-52A demand regulators are located on the lower outboard edges of the instrument panel. These regulators automatically control pressure and quantity to the pilot's face masks according to cockpit altitude requirements. A pressure gage and flow indicator are included as part of the regulator assemblies. A filler valve located on the upper left side of the tailcone aft of the wing provides a means for replenishing the supply from a ground source. Refer to servicing diagram, figure 1-48. Approximate duration of the oxygen supply is shown in figure 1-42.

GASEOUS OXYGEN REGULATORS



1 EMERGENCY LEVER
2 FLOW INDICATOR
3 DILUTER LEVER
4 PRESSURE GAGE
5 SUPPLY LEVER

16-P5

Figure 1-41

Note

> As the aircraft ascends to high altitudes, where the temperature is normally quite low, the oxygen cylinders become chilled. This may result in a rapid decrease in pressure. A rapid fall in oxygen pressure while the aircraft is in level flight, or while it is descending, is not necessarily due to falling temperature. When this happens, leakage or loss of oxygen must be suspected.

GASEOUS OXYGEN REGULATORS

The CRU-52A demand oxygen regulators (figure 1-41) mix air with oxygen in varying amounts according to cockpit altitude, and deliver a quantity of mixture each time the users inhale. At 43,000 feet, the regulators supply positive pressure breathing.

GASEOUS OXYGEN DURATION CHART -- HOURS

GAGE PRESSURE (PSI) / CABIN ALTITUDE FEET	400	350	300	250	200	150	100
25,000	3.08 **2.45**	2.63 **2.14**	2.31 **1.83**	1.96 **1.53**	1.54 **1.22**	1.15 **.91**	.77 **.61**
20,000	3.22 **1.87**	2.82 **1.63**	2.41 **1.39**	2.02 **1.16**	1.61 **.92**	1.20 **.69**	.80 **.46**
15,000	4.24 **1.49**	3.71 **1.31**	3,17 **1.12**	2.65 **.93**	2.12 **.75**	1.58 **.56**	1.06 **.37**
10,000	5.63 **1.20**	4.94 **1.05**	4.21 **.89**	3.52 **.75**	2.80 **.60**	2.10 **.45**	1.41 **.29**

- LIGHT FIGURES INDICATE DILUTER LEVER - NORMAL
- **BOLD FIGURES INDICATE DILUTER LEVER-100%**

EMERGENCY BELOW 100 PSI DESCEND TO ALTITUDE NOT REQUIRING OXYGEN

2 CREW MEMBERS

Figure 1-42

GASEOUS OXYGEN SYSTEM REGULATOR LEVERS

Diluter Lever

Each oxygen regulator panel incorporates a diluter lever. The lever (3, figure 1-41) is located on the lower center of the regulator. This lever is used to select NORMAL OXYGEN or 100% OXYGEN. The lever in the NORMAL position allows the normal flow of oxygen to the mask at all altitudes. When the lever is at the 100% OXYGEN position, cockpit air is shutoff and only 100% oxygen enters the mask.

WARNING

Whenever an oxygen regulator is not used, the diluter lever for that regulator should be in the 100% OXYGEN position. This closes the mixer port on the regulator to keep it clean. In the 100% OXYGEN position with the supply lever OFF, the mask on, a breath cannot be drawn, thereby serving as an indication to place the supply lever to the ON position. With the supply lever in the OFF position and the diluter lever in the NORMAL OXYGEN position, air to the mask will come through the mixer port, but no oxygen will be mixed with it.

Emergency Lever

The emergency lever (1, figure 1-41) is located on the bottom left corner of the regulator panel and is labeled EMERGENCY, NORMAL, and TEST MASK. The lever is a toggle type, spring-loaded from the TEST MASK position only. When depressed to the TEST MASK position, positive pressure will be delivered to the mask; as soon as pressure is relaxed, the lever will automatically return to the NORMAL position. Positioning the lever to EMERGENCY causes continuous positive pressure to be delivered to the mask. Moving the lever to the NORMAL position, will return the system to normal operation.

CAUTION

When positive pressures are required, it is mandatory that the oxygen mask be well fitted to the face. Unless special precautions are taken to insure no leakage, then continued use of positive pressure under these conditions will result in the rapid depletion of the oxygen supply.

OXYGEN HOSE HOOKUP CRU 60/P CONNECTOR

1. INSERT CONNECTOR INTO THE MOUNTING PLATE ATTACHED TO THE PARACHUTE HARNESS. CHECK THAT THE CONNECTOR IS FIRMLY ATTACHED AND THAT THE LOCK PIN IS LOCKED.
2. INSERT MALE BAYONET CONNECTOR ON THE END OF THE OXYGEN MASK, INTO THE FEMALE RECEIVING PORT OF THE CRU-60/P CONNECTOR. TURN BAYONET CONNECTOR TO LOCK PRONGS INTO THE RECESS IN THE LIP OF RECEIVING PORT.
3. COUPLE THE SEAT OXYGEN HOSE TO THE LOWER PORT OF THE CONNECTOR.
4. ATTACH THE BAILOUT BOTTLE HOSE (IF AVAILABLE) TO THE SWIVELING PORT OF THE CONNECTOR BY INSERTING THE MALE COUPLING OF THE BAILOUT BOTTLE HOSE AND TURNING IT CLOCKWISE AGAINST THE SPRING-LOADED COLLAR.

Figure 1-43

Note

Oxygen masks can be tested at any altitude by placing the emergency lever to the test position.

Supply Lever

The supply lever (5, figure 1-41), is located on the bottom right side of each regulator. The lever has two positions, ON and OFF. When the lever is positioned ON, oxygen is permitted to enter the regulator, and in the OFF position, the oxygen supply is cut off. Both levers should be positioned OFF when the system is not in use.

WARNING

When flying SOLO, be sure the copilot's oxygen supply lever is in the OFF position. If left ON, oxygen could be lost at altitude.

GASEOUS OXYGEN SYSTEM REGULATOR INDICATORS

Pressure Gage and Flow Indicator

The oxygen pressure gage (4, figure 1-41), is located on the right portion of the regulator panel and the flow indicator (2, figure 1-41), is located to the left position of the regulator panel. As oxygen flows from the regulator, the flow indicator blinks. The indicator is white on some aircraft and black on others when not in use.

OXYGEN HOSE HOOK UP

Proper attachment of the oxygen mask connector is extremely important to assure that:

1. The oxygen hose does not become accidentally disconnected during flight resulting in loss of oxygen supply to a crew member.
2. The oxygen hose does not prevent quick separation from the seat during ejection.
3. The oxygen hose does not fail during ejection causing injury to the crew member.

CRU-60/P CONNECTOR

The following procedures shall be employed in hooking up the gaseous oxygen supply system through the CRU-60/P multi-directional quick disconnect. Refer to figure 1-43).

1. Insert connector into the mounting plate attached to the parachute harness. Check that the connector is firmly attached and that the lock pin is locked.
2. Insert male bayonet connector, on the end of the oxygen mask hose, into the female receiving port of the CRU-60/P connector. Turn bayonet connector to lock prongs into the recess in the tip of receiving port.

3. Couple the seat oxygen hose to the lower port of the connector.
4. Attach the bailout bottle hose (if available), to the swiveling port of the connector by inserting the male coupling of the bailout bottle hose and turning it clockwise against the spring-loaded collar.

GASEOUS OXYGEN SYSTEM PREFLIGHT CHECK

Refer to figure 1-43 for the correct method of oxygen hose attachment. Both crew members should complete the following preflight check.

P - PRESSURE - The pressure gage should read 425 ±25 psi and should agree approximately with the other regulator pressure gage.

R - REGULATOR - Check Regulator ON. Perform a blowback check on the regulator hose for five seconds on both the NORMAL and 100% OXYGEN position. Little or no resistance to blowing indicates a leaking regulator diaphragm, faulty check valve in diluter air inlet, or a leak between regulator and quick disconnect. Hook up your mask and perform a pressure check. Place the emergency lever to the EMERGENCY position, take a deep breath and hold it. If mask leakage occurs, readjust mask and reaccomplish the check. The oxygen should stop flowing. If the mask appears to be properly fitted, but the oxygen continues flowing, the valve is not holding pressure and should be replaced. Return the emergency lever to NORMAL. If you cannot exhale, the valve is obstructed, defective, or improperly seated and should be corrected or replaced.

I - INDICATOR - With the diluter lever in 100% OXYGEN position, check blinker for proper operation.

C - CONNECTIONS - Check connection secure at the seat. Check regulator hose for kinks, cuts, or cover fraying. Check that male part of the quick disconnect is not warped and the rubber gasket is in place. A 10 to 20 pound pull should be required to separate the two parts. Check mask hose properly installed to connector.

E - EMERGENCY - Check bailout bottle (if used) properly connected and a minimum pressure of 1800 psi. (Pressure gage must be checked during parachute preflight.)

GASEOUS OXYGEN SYSTEM NORMAL OPERATION

1. Before each flight, be sure oxygen pressure gage indicates 425 ±25 psi. If pressure is low, have the oxygen system charged to capacity before takeoff.
2. Diluter lever - NORMAL OXYGEN.
3. Supply lever - ON.
4. Emergency lever - NORMAL.

GASEOUS OXYGEN SYSTEM EMERGENCY OPERATION

In the event either pilot detects symtoms of nausea, proceed as follows:

1. Emergency lever - EMERGENCY.
2. Descend.
3. When it is evident that an emergency condition no longer exists return emergency lever to NORMAL OXYGEN.

WARNING

- In the event of regulator failure, or a leaking mask or hose, positioning the emergency lever to the EMERGENCY position will bypass the regulator and supply the user with positive oxygen pressure. A descent to an altitude not requiring oxygen should be made immediately if such a malfunction should occur.
- Oxygen supply is rapidly reduced when either or both crew members demand 100% oxygen or when the emergency lever is held in the EMERGENCY position.

EJECTION SEATS

Ejection seats (figure 1-44), are installed in the aircraft. The ejection seats will catapult the occupants clear of the aircraft at any speed, altitude, or attitude. Each seat accommodates a back-type parachute, an inertia reel-type shoulder harness, an automatic opening safety belt, a seat-man separator, and a canopy cutter. Each seat is manually adjusted up or down by actuating a seat adjustment lever (6, figure 1-44). Each seat has an emergency disconnect unit on the lower left side containing a headset, receiver, and microphone leads and the oxygen hose which automatically disconnects at the time of seat ejection.

WARNING

- Ground safety pins are inserted above the right arming handle of each seat and the canopy initiator on the left side of the cockpit, when the aircraft is on the ground and during maintenance operations, and are removed before takeoff. If the pins are left in place, canopy jettisoning and seat ejection are prevented.
- The arming handle safety pins do not safety the canopy jettison system if the external canopy jettison "T" handle is pulled.
- It is necessary to check that the seat catches have engaged after a seat has been adjusted up or down. If the catches are not engaged,

the seat may not eject from the aircraft during ejection, or may inadvertently move during flight.

- Do not use any additional seat cushions except those which are furnished with the aircraft. If additional seat cushions are used, and if ejection becomes necessary, serious spinal injuries can result when the ejection force compresses the cushions, enabling the seat to gain considerable momentum before exerting a direct force on the pilot or copilot. Chance of injury during forced landing is also increased.

- Before lowering seat, check area for objects that would prevent the arming handles from lowering with seat, resulting in jettisoning of canopy and arming of the seat.

- After canopy has been jettisoned, purposely or otherwise, and seat ejection has not been accomplished, no attempt should be made to place the arming handles back down. The arming handles are held in the up position by means of a mechanical lock. In the event of damaged firing devices, any movement of the arming handles or trigger might jettison the seat with possible injury to the person attempting such action.

EJECTION SEAT ARMING HANDLES

When the arming handles (3, figure 1-44) are raised to the full up position they lock in the up position exposing the seat ejection trigger, locking the shoulder harness, and jettisoning the canopy. The linkage is such that both arming handles are interconnected and will raise together.

SEAT EJECTION TRIGGER

The seat ejection trigger (8, figure 1-44) is located within the ejection seat right arming handle on each seat and is accessible only when the arming handles are in the full up position. Squeezing the trigger fires the initiator, and expanding gases eject the seat.

SHOULDER HARNESS LOCKING LEVER

The locking lever (2, figure 1-44) with LOCKED and UNLOCKED positions provides for manual control of the shoulder harness locking feature. When the shoulder harness is not manually locked, an inertia reel will automatically lock it when a sudden deceleration force of approximately two to three G's is applied. If the locking lever is placed in the LOCKED position while the occupant is leaning forward, the inertia reel will automatically retract slack harness with each aft movement of the occupant until the fully retracted position has been reached.

SEAT-MAN SEPARATOR

A seat-man separator (9, figure 1-44) on each seat provides automatic and positive separation of the seat and occupant after ejection from the aircraft. The separator is actuated by a one-second delay initiator mounted on the seat back. After ejection, the separator winds-up the strap attached to the separator and seat bottom, separating the seat and occupant.

AUTOMATIC OPENING SAFETY BELTS AND AUTOMATIC OPENING PARACHUTES

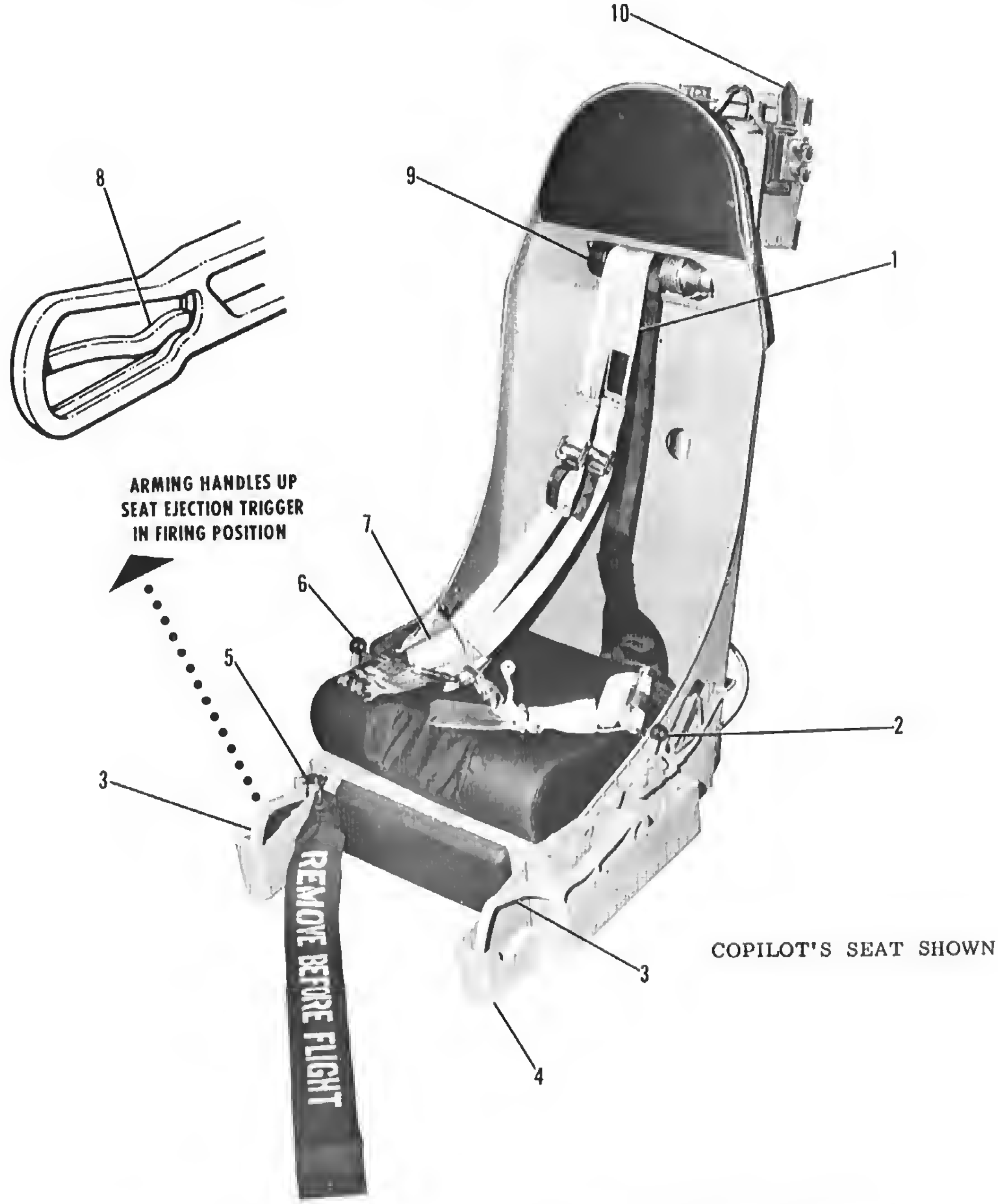
AUTOMATIC OPENING SAFETY BELTS

In order to provide a quick separation from the seat after ejection, an automatic safety belt release mechanism is incorporated in each ejection seat. The system consists of a trigger, a safety belt release initiator, ballistics tubing, and an automatic opening safety belt, (figure 1-45). The safety belt initiator is triggered by the seat as it leaves the aircraft; after a one-second delay, the initiator fires and the expanding gas operates the safety belt automatic opening mechanism. Upon automatic opening of the belt, only the shoulder harness will be released; the parachute arming lanyard will be securely attached to the safety belt and to the seat, leaving the occupant free to separate from the seat. The automatic opening feature of the parachute is activated by the occupant's separation from the seat. Figure 1-45 shows the automatic opening safety belts in the locked, manually opened, and automatically opened conditions. If the safety belt is opened manually the parachute arming lanyard anchor will not be retained to pull the parachute arming lanyard.

WARNING

Do not open the automatic safety belt prior to ejection, regardless of altitude. Since the deceleration of a crew member alone is considerable greater than that of the crew member and seat together, immediate separation would result if the safety belt were manually opened prior to ejection. This could result in the parachute pack being blown open and injuries caused by a high opening shock of the parachute.

EJECTION SEAT



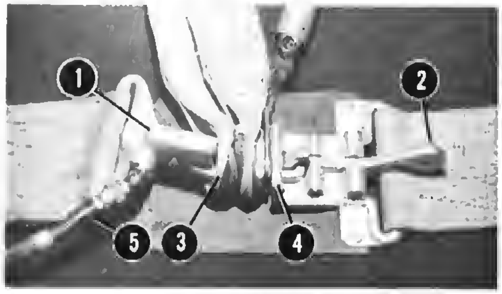
1. SHOULDER HARNESS
2. SHOULDER HARNESS LOCKING LEVER
3. ARMING HANDLE
4. ARMING HANDLE GUARD
5. ARMING HANDLE SAFETY PIN
6. SEAT ADJUSTMENT LEVER
7. SAFETY BELT
8. SEAT EJECTION TRIGGER
9. SEAT-MAN SEPARATOR
10. CANOPY BREAKER

Figure 1-44

SAFETY BELT

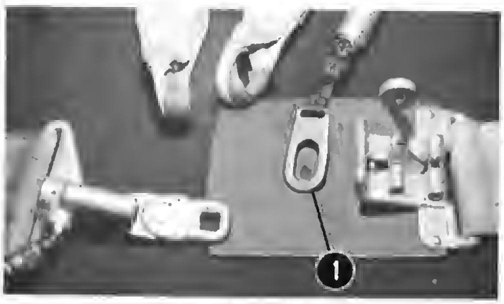
AUTOMATIC OPENING TYPE

TYPE M-6 BELT



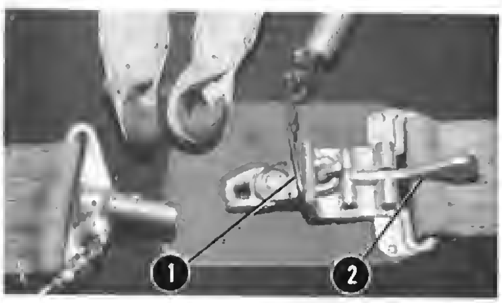
LOCKED CONDITION

1. Automatic Release
2. Manual Release
3. Swivel Link
4. Parachute Arming Lanyard Anchor
5. Hose From Safety Belt Initiator



MANUALLY OPEN

1. Parachute Arming Lanyard Anchor Free



AUTOMATICALLY OPEN

1. Parachute Arming Lanyard Anchor Retained By Shoulder On Swivel Link
2. Manual Release Handle Locked

Figure 1-45

TYPE MA-6 AUTOMATIC OPENING SAFETY BELTS

On the type MA-6 safety belts as installed in the aircraft, the parachute arming lanyard anchor is looped over the safety belt swivel link in the same manner as the shoulder harness loops. To close the belt, the shoulder harness loops are placed on the tongue, then the parachute arming lanyard anchor. See figure 1-45 for detailed illustration. The seat occupant should be certain that the shoulder harness loops are not binding on the safety belt automatic release cylinder (to which the release initiator hose is attached). This should be checked when the belt is fastened.

WARNING

- The order of installation of shoulder harness loops and parachute arming lanyard anchor must not be varied. If wrongly installed, it is possible to prevent automatic separation from the seat, in which case the belt must be manually opened to accomplish separation from the seat, and the parachute arming knob must be pulled manually to arm or open the parachute.
- If the shoulder harness loops pass over the safety belt automatic release cylinder, the loops can hang up and delay separation from the seat after ejection.
- If the automatic opening safety belt is opened manually, the automatic parachute release will not be actuated unless the parachute arming knob is pulled.

Note

The ballistics hose fitting (figure 1-45) on the safety belt should be checked to ascertain that is has been tightened to a position that allows the hose to lay as close to the belt as possible. If the fitting is pointing down it can force the hose down against the seat occupant's leg causing discomfort. If the fitting is pointing up it forces the hose to extend up and form a loop which could hang on aircraft structure or entangle the seat occupant's arm.

AUTOMATIC OPENING PARACHUTES

The ejection seats are designed to utilize a back-type automatic opening parachute. Automatic release from the seat following ejection and automatic opening of the parachute results in quicker deployment of the parachute. In order to accomplish automatic opening, the parachute is equipped with an automatic ripcord release mechanism. An aneroid device and timer are incorporated in the release mechanism to pull the ripcord when the preset altitude is reached. The parachute timer is preset for a number of sec-

onds delay. The aneroid device is set according to instructions contained in applicable technical publications, and as aircraft flight areas dictate. The chain of events in the release mechanism is activated by the parachute arming lanyard which is attached to the automatic opening safety belt by a metal parachute arming lanyard anchor for automatic operation. An orange knob is attached to the parachute arming lanyard for manual operation. Upon separation from the seat, the parachute arming lanyard remains attached to the safety belt activating the release mechanism. When activated above the preset altitude, the parachute will remain closed until the preset altitude is reached, then open. When the release mechanism is activated below the preset altitude, the parachute will open after the number of seconds delay set on the timer. The parachute is equipped with a parachute ripcord handle for opening the parachute manually.

WARNING

For automatic parachute deployment:

1. The automatic safety belt initiator pin must be removed.
2. The parachute arming lanyard anchor must be fastened to the safety belt.
3. The safety belt must open automatically.

If any one of the above conditions is not met the parachute arming knob must be pulled for automatic parachute deployment.

Note

- The automatic opening parachute can be opened manually at any time by pulling the parachute ripcord handle.
- If it is necessary that either the parachute ripcord handle or the parachute arming knob be pulled to open the parachute, use the parachute ripcord handle if below 14,000 feet and the parachute arming knob if above.

ONE AND ZERO SYSTEM

In order to provide an improved low altitude escape capability, a system incorporating a one-second safety belt delay and a zero-second parachute delay ("one and zero" system) is provided for ejection seat escape. This system (figure 1-46) makes use of a detachable zero delay lanyard attached to the parachute arming knob. When the hook on the other end of the zero delay lanyard is attached to the parachute ripcord handle, the automatic timer is by-passed and, upon separation from the seat after ejection, the parachute ripcord handle is pulled immediately without any delay. A stowage ring is provided to stow the hook when it is not attached to the parachute ripcord handle. At altitudes above 10,000 feet pressure altitude or at high airspeeds the zero delay lanyard must be disconnected from the parachute ripcord handle,

ONE AND ZERO EJECTION SYSTEM

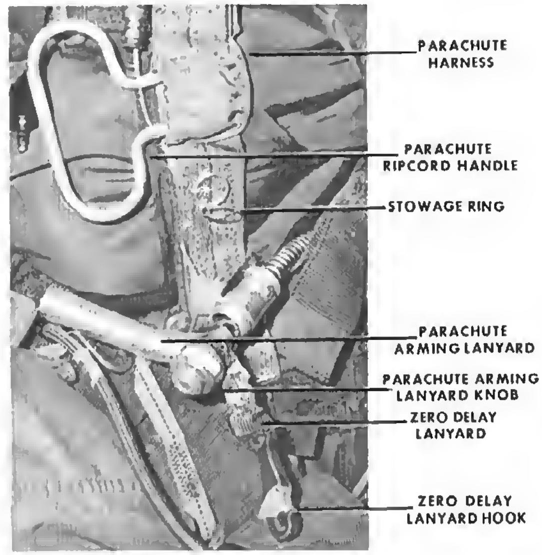


Figure 1-46

thus allowing the parachute timer or the aneroid device to actuate the parachute.

Before takeoff the zero delay lanyard must be hooked to the parachute ripcord handle, after takeoff the zero delay lanyard normally remains connected below 10,000 feet pressure altitude including flights in which 10,000 feet pressure altitude may be temporarily exceeded.

Before penetration or passing 10,000 feet pressure altitude during descent, the zero delay lanyard should be hooked up. After landing it is not necessary to disconnect the zero delay lanyard from the parachute ripcord handle since it connects the parachute ripcord handle to the parachute arming lanyard knob and is not attached to the safety belt. The minimum emergency ejection altitude paragraph in Section III will permit the determination of the emergency minimum altitude for successful ejection with different combinations of automatic parachute timing sequence. The "one and zero" system has been successfully flight tested at speeds between 120 KIAS and the maximum safe parachute opening speeds.

WARNING

- The emergency minimum ejection altitudes specified for one second safety belt and zero-second parachute setting apply when the zero delay lanyard is attached to the parachute ripcord handle and the parachute arming lanyard anchor is attached to the automatic opening safety belt.
- Since use of the parachute ripcord handle will open the parachute without delay, no time is allowed for slow down before the parachute opens; therefore, the zero delay lanyard should never be attached to the parachute ripcord handle during operations at high altitudes or airspeeds in order that the safety-delay provided by the parachute timer and aneroid devices will not be overridden.

Refer to Section III for additional information and seat ejection procedures.

MISCELLANEOUS EQUIPMENT

MAP AND DATA CASE

A map and data compartment is provided on both sides of the cockpit. This map and date compartment is a part of the upholstery. A safety pin storage compartment is located on the left side of the cockpit and is part of the upholstery. A box in the right-hand nose section is also provided for safety pin storage.

REAR VISION MIRROR

Adjustable rear-vision mirrors are mounted on the inner surface of the canopy just aft of the canopy bow. Mirrors are provided for both the pilot and copilot's side of the canopy.

SEAT SURVIVAL KIT

Provisions for a seat survival kit are in each ejection seat. The kit contains a 1-man life raft, MK-13 M-O flares, sea marker packet, and shark repellent compound.

CANOPY BREAKER ESCAPE TOOL

A canopy breaker knife is mounted in a bracket on the canopy bow. The knife can be used for cutting through the canopy during an emergency, whenever the canopy fails to jettison. The canopy breaker knife is shown in figure 1-47, along with the proper way of holding the knife. When using the knife make sure that the curved edge of the knife is toward the person using it, this will prevent the knife from glancing off the canopy and causing possible injury to the user.

CANOPY BREAKER

Figure 1-47

SERVICING DIAGRAM

	MIL. SPEC.	GRADE	NATO CODE
FUEL	MIL-J-5624	JP-4	F-40
	MIL-J-5624	JP-5	F-44
Alternate	MIL-G-5572D	115/145	F-22
HYDRAULIC FLUID	MIL-H-5606		H-515
OIL	MIL-L-007808F	None	O-148
OXYGEN	MIL-O-27210		

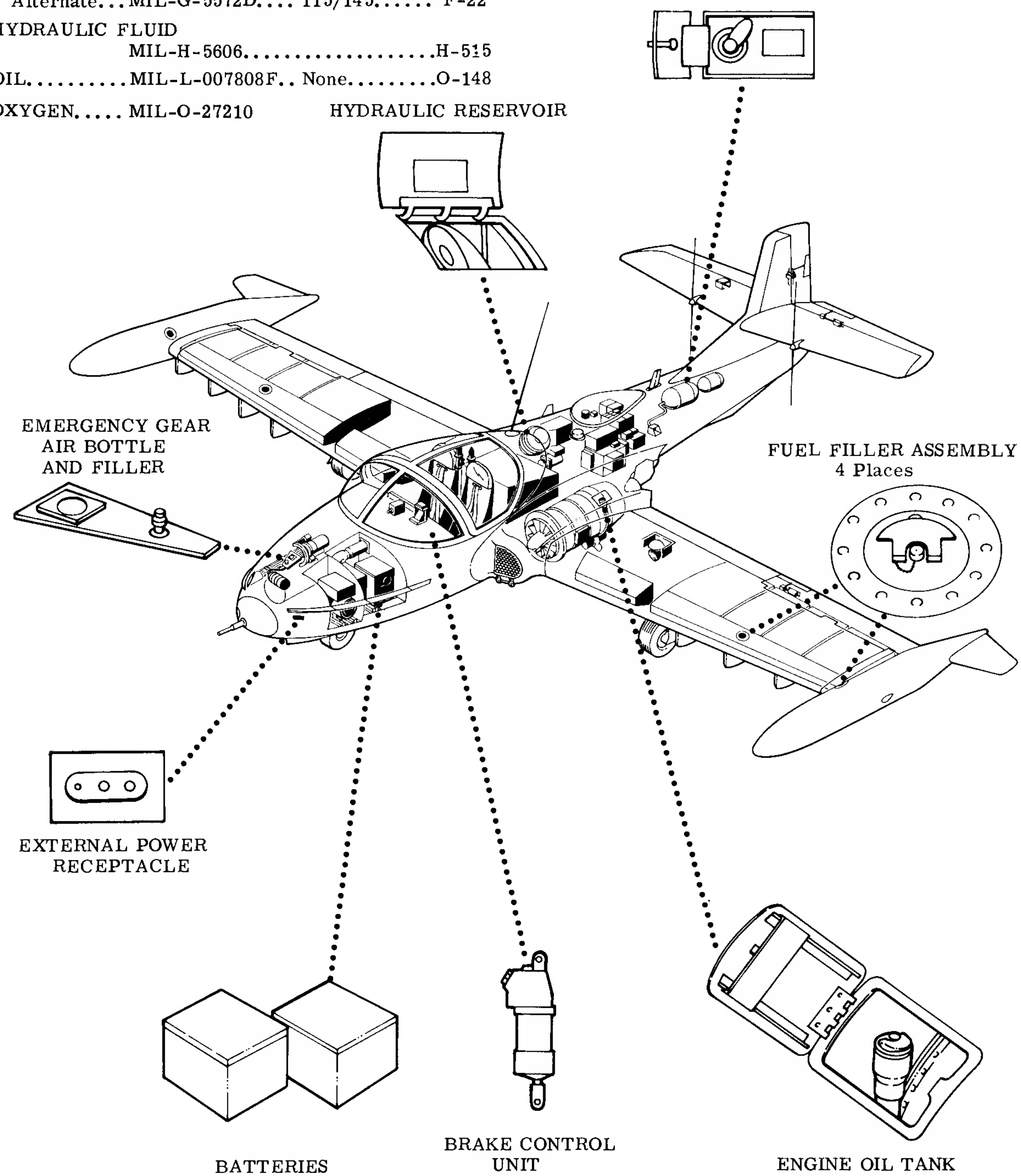


Figure 1-48

SECTION II

NORMAL PROCEDURES

TABLE OF CONTENTS

PREFLIGHT CHECK

The exterior inspection will be influenced to some extent by the type of operation encountered, i.e. cold weather, hot weather, etc. Refer to Section VII for additional weather information. During normal operation, proceed as follows:

BEFORE EXTERIOR INSPECTION

1. Form 781 - CHECK.
   Check for status, exceptional release, fuel, oxygen, oil, and remarks pertaining to the condition of the aircraft.
2. Electrical power - OFF.
3. Oxygen quantity - CHECK.
   Line connections secure, check quantity. Lines are located behind the seats. Quick-disconnect plates should be safetied together.
4. Publications - CHECK.
5. Bob weight scale - ADJUST, CHECK, and SAFETY.
   (Full clockwise with four fuel drop tanks installed. Full counterclockwise with four M117 GP bombs installed. Center for all other configurations.

EJECTION SEAT AND CANOPY CHECK

1. Safety pins - INSTALLED.
   a. Canopy jettison "T" handle.
   b. Seat arming handle.
2. Handgrips and trigger - CHECK.
3. Seat-man separator - CHECK for cuts and frays.
4. Tubing and hose fittings - CHECK.
5. Canopy control switch - INTERNAL.

EXTERNAL INSPECTION

1. Gear safety pins - REMOVED.
2. Nose gear torque link safety pin - INSTALLED.
3. Engine intakes - CLEAR.
4. Tires - CONDITION.
5. External loads - CHECK.
6. Fuel tanks - CHECK QUANTITY.

RIGHT SEAT CHECK (SOLO FLIGHTS)

1. Circuit breakers - CHECK.
2. Speed brake switch - SOLO.
3. Map and data case - CHECK.
4. Seat arming handle safety pin - INSTALLED.
5. Shoulder harness, oxygen hose, radio cord, and seat belt - SECURE.
6. Oxygen supply lever - OFF.
7. Oxygen diluter lever - 100% OXYGEN.

COCKPIT CHECK (ALL FLIGHTS)

General

1. Seat survival kit - CONNECT.
2. Seat belt, shoulder harness and parachute arming lanyard - FASTENED and ADJUSTED.

WARNING

To permit clean separation from the seat during ejection, the parachute arming lanyard must be outside the parachute harness and not fouled on equipment.

3. Oxygen system - PRICE CHECK.
4. Oxygen and radio leads - CONNECT.
5. Zero-delay lanyard hook - CONNECT.
6. Seat - ADJUST.

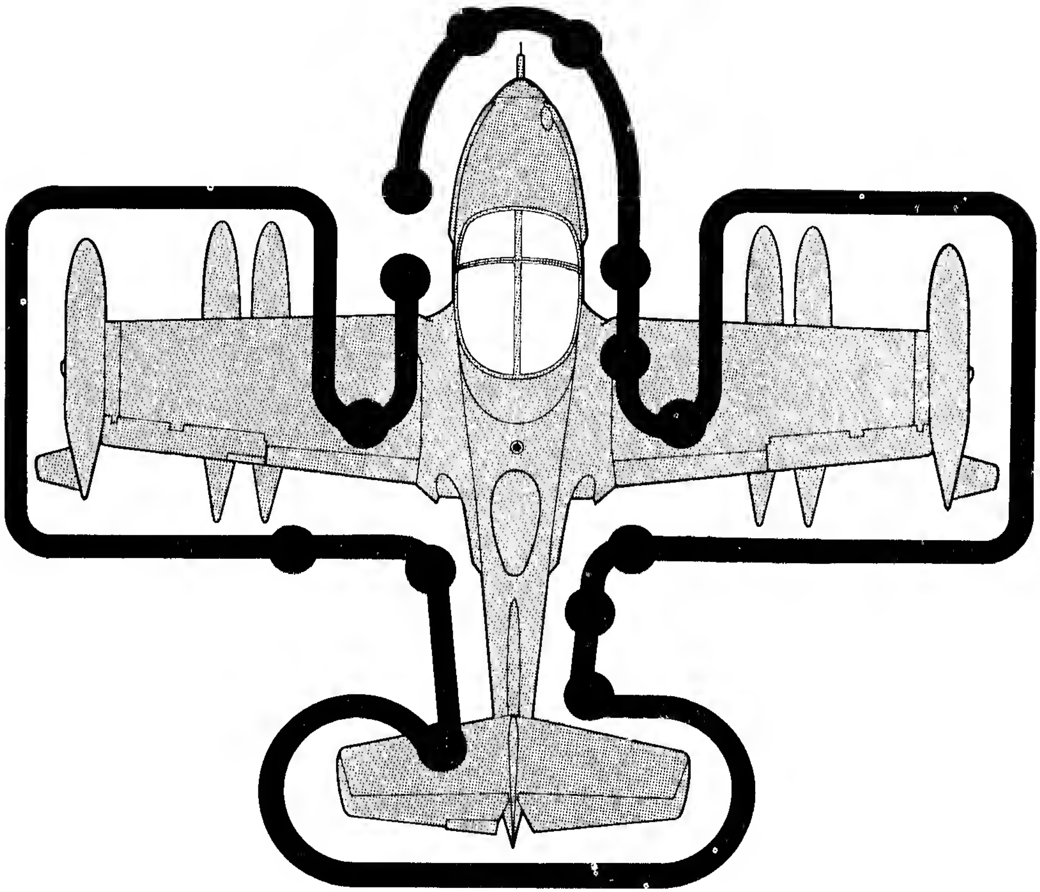
WARNING

Check arming handles safety pin installed and area under seat clear of foreign objects before lowering seat to prevent inadvertent canopy jettison.

After adjusting seat to proper height, check that adjustment lever is locked. If seat is not locked, G-loads in flight may cause it to move, or prevent safe ejection. To check locked, move seat up and down.

7. Rudder pedals - ADJUST.
8. Control lock - STOWED.
9. Flight controls - CHECK.

EXTERIOR INSPECTION



STARTING AT THE FORWARD LEFT SIDE OF THE AIRCRAFT PERFORM THE EXTERIOR INSPECTION AS OUTLINED IN THE TEXT IN ADDITION TO CHECKING THE AIRCRAFT SURFACES FOR WRINKLES, DENTS, LOOSE RIVETS, OIL, FUEL OR HYDRAULIC LEAKS, AND ACCESS DOORS AND PLATES FOR SECURITY.

Cockpit Left Side

1. Map and data case - CHECK.
2. Camera intervalometer - SET.
3. Ground arm switch - OFF.
4. Camera switch - OFF.
5. Intercom controls - AS DESIRED.
6. Flap handle - UP.
7. Speed brake switch - IN.

Cockpit Front

1. Landing gear lever - DOWN.
2. Landing and taxi light switch - OFF.
3. Gunsight light control switch - FULL DIM.
4. Compass In-Out-Fast slave switch - IN.
5. Clock - SET.
6. Fuel shutoff "T" handles - PUSH-ON.
7. All armament panel switches - OFF.
8. Armament circuit breakers - IN.
9. Seat tank and auxiliary pylon tank switch - MAIN.
10. Tip tank switches - NORMAL.
11. Fuel gauging selector switch - TOTAL.
12. Fuel system switch - GRAVITY.

CAUTION

If the fuel system switch is placed in the NORMAL position and the float switch located in the fuselage fuel tank is stuck, the fuel proportioner pump will operate continuously when electrical power is applied to the aircraft. If the engines are not running, the fuel proportioner pump can supply enough pressure to damage the fuselage fuel tank.

13. Rounds counter - SET.
14. Radios and Nav aids - OFF.
15. X-Band beacon switch - OFF.
16. Antenna switches - AUTO.
17. Air conditioning controls - AS DESIRED.
    a. Cockpit air temperature control rheostat - AS DESIRED.
    b. Defrost knob - IN.
    c. Bleed air switches - ON.
18. Pitot heat switch - OFF.
19. Generator switches - ON.
20. Battery switch - OFF.
21. Inverter switch - OFF.
22. Fuel boost pump switch - OFF.
23. Engine inlet screen switch - AUTO.

Note

On unimproved field or if potential FOD is obvious place screen switch in the EXTEND position until after takeoff.

24. Anti-collision beacon switch - OFF.
25. Nav light switch - OFF.
26. Landing gear emergency "T" handle - IN.

Cockpit Right Side

1. Intercom controls - AS DESIRED.
2. Circuit breakers - IN.

Cockpit Center Pedestal

1. Throttles - CUT-OFF.
2. Interior light switches - OFF.
3. ADF - OFF.

ELECTRICAL POWER ON

1. Battery switch - ON (OFF if APU is used).
2. Caution and warning lights - CHECK (PRESS test switch).
    a. Master caution warning light.
    b. Engine ice warning light.
    c. Right tip tank empty warning light.
    d. Inlet screens extended warning light.
    e. Left tip tank empty warning light.
    f. Fuel low level warning light.
    g. Pylon tanks empty warning light.
    h. Fuel gravity warning light.
    i. Seat tank empty warning light.
    j. Fuel boost off warning light - ON.
    k. Takeoff trim warning light - ON.
    l. Left generator out warning light - ON.
    m. Right generator out warning light - ON.
    n. Inverter out warning light - ON.
3. Gear warning - CHECK.
   The gear warning light will illuminate when button is depressed. To check the audio horn move one throttle above the idle detent and horn will sound.
4. Interior lights - AS REQUIRED.
5. Exterior lights - BRIGHT & FLASH.
6. J-8 Attitude indicator - CAGE and HOLD.
   Check proper operation and adjust the horizon bar to coincide with miniature aircraft.
7. Inverter switch - SPARE.
8. Fuel quantity - TEST and CHECK WING TANKS.

PRIOR TO STARTING ENGINES

1. All loose items - STOWED.

STARTING ENGINES

1. Fuel boost pump switch - ON.

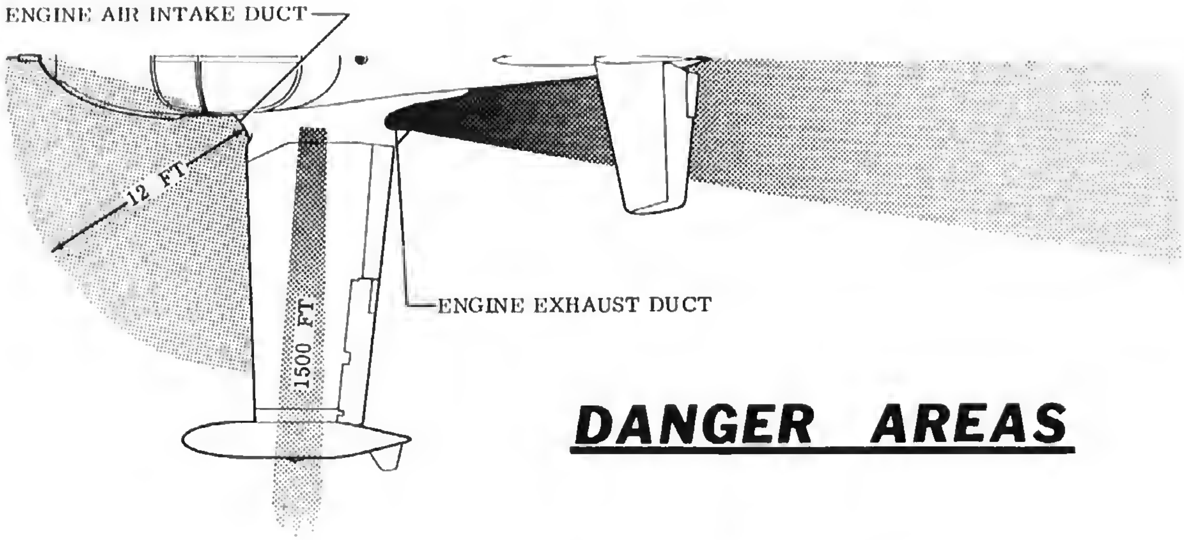
Note

If the fuel boost pump warning light fails to go out, do not start engines and note in Form 781-2.

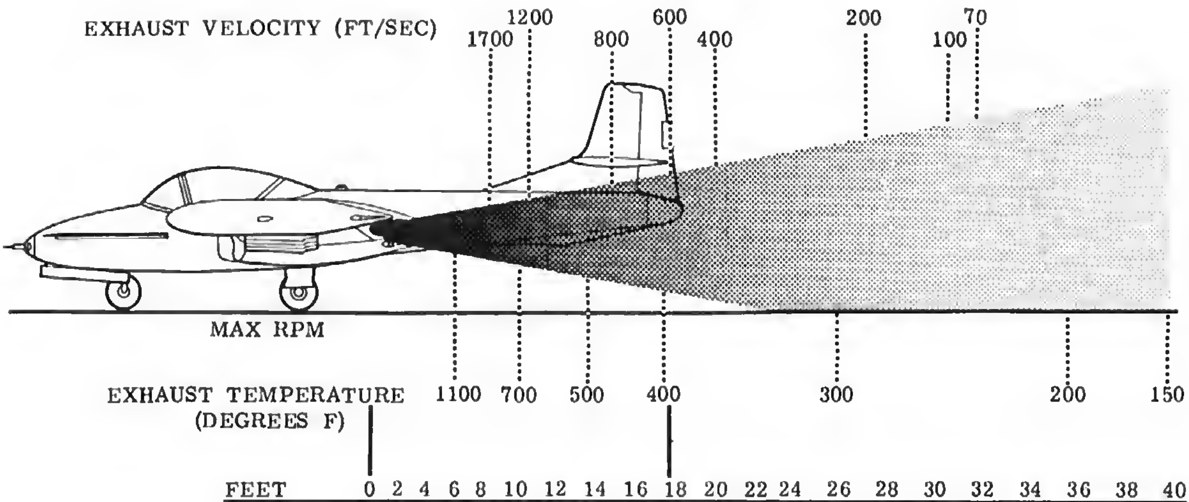
2. Battery switch - ON (OFF if APU is used).
3. Left engine start:
    a. Starter switch - AIR.
    b. Throttle - IDLE at 6 to 8% RPM.

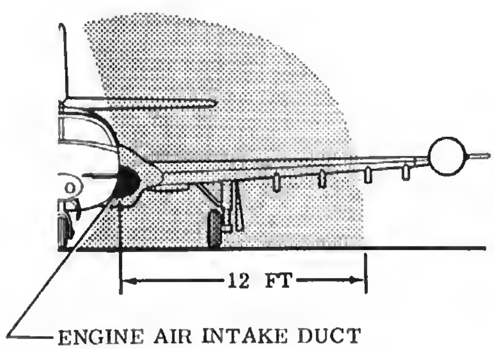
Note

To prevent damage to starter-generator, do not use external power units which exceed 900 ampere output.



DANGER AREAS





WARNING

- Suction at the engine intake duct is sufficient to kill or severely injure personnel drawn into, or against the duct.
- Danger areas behind the aircraft are created by high exhaust temperatures and velocities. The danger increases with maximum thrust operations.
- Use minimum power for taxi.

16037

Figure 2-2

Note

- Use copilot's throttle for starting so that cut-off feature is available if shutdown is necessary.
- If EGT exceeds 900° during start, abort the start to preclude exceeding transient limits. If EGT exceeds 1000°, record EGT and duration of high EGT in Form 781.

CAUTION

After engine start, advance throttle until generator cuts in at approximately 48-50% rpm and check loadmeter for rise in indication. If loadmeter shows no rise, increase rpm to 65%. If still no loadmeter indication, shutdown both engines and write up in Form 781.

c. Engine instruments - CHECK.
d. APU - DISCONNECT (if applicable).
e. Battery switch - ON (if APU is used).
f. Loadmeter - CHECK.

4. Hydraulic pressure - CHECK for 1250 to 1550 psi.
5. Engine inlet screens - CHECK EXTENDED.
6. Left engine RPM - ADVANCE TO 60%.
7. Right engine start - SAME PROCEDURE as above.
8. Fuel system switch - NORMAL.
9. Inverter switch - MAIN.

STARTING ENGINES (ALTERNATE)

Note

Use this alternate method if APU is not available and the batteries are low.

1. Fuel boost pump switch - ON.

Note

If the fuel boost pump warning light fails to go out, do not start engines and note in Form 781-2.

2. Battery switch - SERIES START.
3. Left engine start:

a. Starter switch - GND and Hold.

Note

- Do not leave starter switch in the GND position for more than 20 seconds if there are no indications of combustion (EGT rise). The batteries will sustain two start attempts.
- Wait one minute before repeating start procedure to allow accumulated fuel to drain from engine. If engine does not accelerate as in normal start, because of low battery voltage, abandon the start and use auxiliary power.

b. Ignition switch - ON at 3% rpm and Hold.

Note

Use copilot's throttle for starting so that cut-off feature is available if shutdown is necessary.

c. Throttle - IDLE at 6% to 8% RPM.
d. Ignition switch - OFF at rapid EGT rise.
e. Starter switch - OFF at 40% RPM.

Note

- A high heat peak is reached at 32-34% rpm. Holding the starter in GND position beyond this peak, will result in a cooler, more stabilized start.
- If EGT exceeds 900° during start, abort the start to preclude exceeding transient limits. If EGT exceeds 1000°, record EGT and duration of high EGT in Form 781.

CAUTION

After engine starter switch is released and checked to be in the OFF position, advance throttle until generator cuts in at approximately 48-50% rpm and check loadmeter for rise in indication. If loadmeter shows no rise, increase rpm to 65%. If still no loadmeter indication, shutdown both engines and write up in Form 781.

f. Engine instruments - CHECK.
g. APU - DISCONNECT (if applicable).
h. Battery switch - ON.
i. Loadmeter - CHECK.

4. Hydraulic pressure - CHECK for 1250 to 1550 psi.
5. Engine inlet screens - CHECK EXTENDED.
6. Left engine RPM - ADVANCE TO 60%.
7. Right engine start - SAME PROCEDURE as above.
8. Fuel system switch - NORMAL.
9. Inverter switch - MAIN.

BEFORE TAXIING

1. Radios and Nav aids - ON and CHECK.
2. Trim operation - CHECK, run from stop to stop.
3. Trim for takeoff - CHECK, green light ON.
4. Engine inlet screens - CHECK OPERATION.
5. Speed brake - CHECK OPERATION.
6. Flaps - DOWN. Check operation and verify flap extension with ground crew.
7. IFF - STANDBY.
8. Altimeter - SET and CHECK.

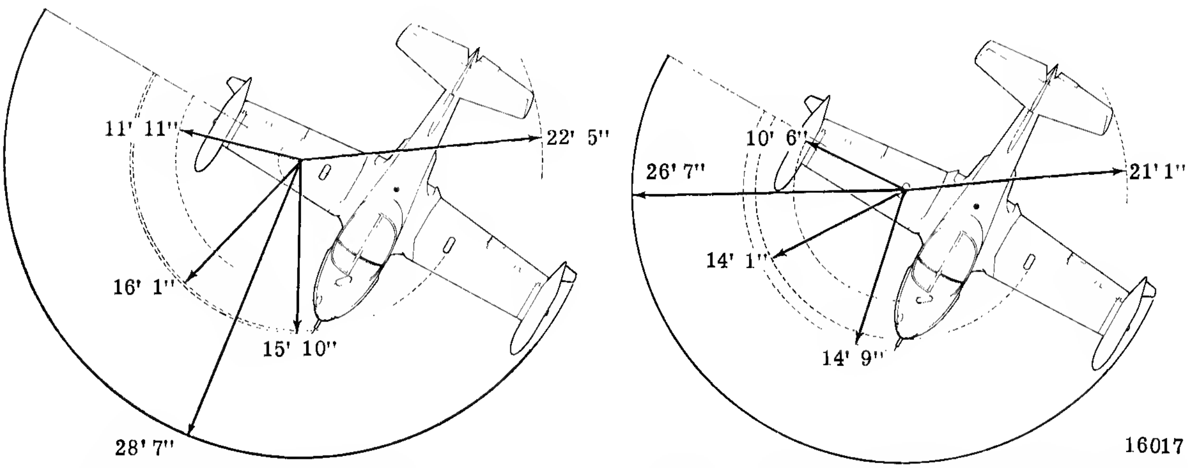
WARNING

Special attention should be given to the altimeter, when setting the barometric scale, to assure that the 10, 000 foot pointer is reading correctly. The low altitude symbol should be visible below 16, 000 feet.

Minimum Turning Radius and Ground Clearance

MINIMUM GROUND CLEARANCE

PITOT TUBE	2 FT. 10 IN.
WING TIP	3 FT. 4 IN.
TIP TANK	3 FT.
MAIN GEAR INBOARD DOORS	6 IN.
MAIN GEAR OUTBOARD DOORS	10 IN.
VENTRAL FIN	2 FT. 10 IN.



NOSE WHEEL STEERING ONLY **NOSE WHEEL STEERING AND BRAKES**

Figure 2-3

9. Safety pins - REMOVE.

a. Canopy jettison "T" handle safety pin - REMOVE and visually display.

b. Ejection seat safety pins - REMOVE and visually display.

WARNING

- When removing ejection seat arming handles safety pin, place left hand on the left arming handle to insure that the arming handles are held down while the pin is removed and streamer is cleared from the seat.
- During all ground operation, if seat adjustments become necessary, install arming handles safety pin before moving the seat adjustment lever.
- In flight, exercise extreme care to insure that feet are clear of the arming handles and that the proper handle is moved to raise and lower the seat.

10. Canopy - CHECK, then as desired.
11. Parking brake "T" handle - RELEASED.
12. Chocks - REMOVED.
13. Nose wheel steering - CHECK.
    Depress and release; maintain directional control with steerable nose wheel by use of rudder pedals. To disengage depress and release.

Note

Nose wheel steering should be used with care to prevent overcontrolling while taxiing. Attempts to use a combination of nose wheel steering and brakes to maintain direction may result in overcontrolling. Avoid braking during turns, taxiing over foreign objects, holes and ruts.

14. Brakes - CHECK.
    When aircraft is moving straight forward, apply brakes evenly and frimly to check for adequate braking action.

CAUTION

- Do not exceed 60% rpm on one throttle with thrust attenuators extended.
- Use minimum power for taxi.
- Do not ride brakes to control taxi speed. Control taxi speed with thrust attenuators.
- To prevent inadvertent jettisoning or damage to the canopy, do not unlock or open canopy above 40 KIAS.

TAXIING

1. Flight instruments - CHECK.
   a. Altimeter - CHECK.
   b. Airspeed indicator - CHECK READING.
   c. J-2 directional indicator - CHECK READING. Set takeoff heading under top index; check heading against magnetic compass.
   d. Standby magnetic compass - CHECK. Determine that bowl is full of fluid.
   e. J-8 attitude indicator - CHECK for attitude warning flag not showing.
   f. Turn and slip indicator - CHECK. During turns, check that turn needle indicates the proper direction and ball is free in the glass tube.

BEFORE TAKEOFF

1. Zero-delay lanyard hook - CONNECTED.
2. Flight controls - CHECK for freedom of movement.
3. Takeoff trim - CHECK.
4. Pitot heat switch - AS REQUIRED.
5. Exterior lights switches - AS REQUIRED.
6. Flaps - CHECK DOWN.
7. Tip tank switches or auxiliary pylon switch - ON.
8. IFF - AS REQUIRED.
9. Caution and warning lights - CHECK.
10. Loadmeters - CHECK.
11. Anti-collision beacon switch - AS REQUIRED.
12. Speed brake switch - CHECK IN.
13. Canopy - CLOSED and LOCKED. Check light out. Before closing canopy, check that canopy sill is free of obstructions and notify other crew member. Wait for confirmation that he is clear, then hold canopy switch in the CLOSE position until the canopy is fully closed. After the canopy is closed, move the locking handle forward and check that the "canopy-not-locked" red warning light goes out.

PREFLIGHT ENGINE CHECK

1. Throttles - 85% RPM.
2. Engine instruments - CHECK for proper indication.
   a. Tachometers.
   b. Fxhaust gas temperature indicators.
   c. Fuel flow indicators.
   d. Oil pressure indicators.
   e. Master caution light - OUT.
   f. Hydraulic pressure gage.
   g. Loadmeters.

Note

- Nickel cadmium batteries may be charged at a much greater rate without damage than can the conventional lead-acid batteries. Engine starts using battery power will normally be followed by extremely high loadmeter readings. High loadmeter readings may persist for as long as 10 minutes after takeoff. Loadmeter reading will gradually decrease as the battery becomes charged unless some electrical malfunction is present.
- The loadmeters should be checked immediately after takeoff and every 15 minutes thereafter. After 10 minutes of flight, loadmeter reading should be .5 or below. Maximum loadmeter for takeoff is .8.

3. Heat and vent system - AS REQUIRED.
4. Throttles - MAXIMUM at brake release.

Note

At high rpm settings under humid atmospheric conditions, it is normal to observe vapor coming out of the air scoop on the nose section.

TAKEOFF

Refer to Appendix I for takeoff charts showing distances required at varying gross weights, temperatures, field elevations, wind and runway conditions. After completion of the Preflight Engine Checks, release brakes and establish a straight takeoff roll. Directional control should be maintained by use of nose wheel steering until rudder becomes effective at approximately 60 KIAS. Care should be used to prevent overcontrolling when using nose wheel steering. As the elevators become effective (at approximately 65 KIAS), raise the nose smoothly to takeoff attitude. Maintain this attitude and allow the aircraft to fly off the ground.

CROSSWIND TAKEOFF

Release brakes and maintain directional control by use of the nose wheel steering, ailerons, and rudder. Release nose wheel steering at the computed minimum nose wheel lift-off speed (refer to crosswind chart in Appendix) and raise nose to the normal takeoff attitude. Continue to use rudder and ailerons for maintaining directional control. After becoming airborne, correct for drift by turning into the wind. Observing the minimum nose wheel lift-off speed will insure sufficient rudder control to maintain runway heading prior to becoming airborne.

AFTER TAKEOFF

1. Gear lever - UP. (110 KIAS minimum)

Note

Gear limit speed 150 KIAS.

2. Flap handle - UP.
3. IFF - CHECK.

CLIMB CHECKS

1. 2000 to 5000 feet:
   a. Oxygen diluter lever - NORMAL.
   b. Yaw damper switch - ON.
   c. Drop tanks switch - AS REQUIRED.

Note

To increase the service life of the tip tank transfer pumps, the pumps should be turned off when using drop tank fuel.

2. 10,000 feet:
   a. Zero-delay lanyard - DISCONNECT when passing through 10,000 feet pressure altitude when this altitude will be exceeded for prolonged periods.

Note

If operating above terrain over 8000 feet high, the zero-delay lanyard should remain connected until the aircraft is at least 2000 feet above terrain on descent.

3. 18,000 feet:
   a. Altimeter - 29.92.

LEVEL OFF SAFETY CHECK

1. Oxygen system - CHECK.

WARNING

Leaving the oxygen diluter lever in the 100% OXYGEN position will greatly shorten the duration of the oxygen system. Refer to figure 1-42 for oxygen duration.

2. Engine instruments - CHECK.
3. Loadmeters - CHECK.
4. Fuel - CHECK.

CRUISE

Refer to Appendix I for cruise data.

Note

If operating above terrain over 8000 feet high, the zero-delay lanyard should remain connected until the aircraft is at least 2000 feet above terrain, and should be connected at least 2000 feet above terrain on descent.

FUEL SYSTEM MANAGEMENT

Operation of the fuel internal system is essentially automatic, requiring no action from the pilot during flight. However, it is important to keep in mind the following conditions which will convert the fuel system from normal gravity operation automatically.

1. The fuel system switch should be in the NORMAL position for all normal operation.

Note

Refer to paragraph, Fuel Unbalance, for operation of fuel system switch when a fuel unbalance is detected.

2. If the fuel level descends, for any reason, to the low level float switch, the switch actuates the red low level warning light on the annunciator panel, and automatically shuts off the proportioner pumps and deenergizes the solenoid locked shutoff valve, which allows fuel to bypass the proportioner pumps and enter the fuselage tank by gravity. The amber gravity feed light on the annunciator panel will be turned on when the solenoid-locked fuel shutoff valve has opened. As gravity feed raises the fuel level in the fuselage tank, the red low level warning light will go out. If there has not been an electrical failure in the proportioner pumps circuit, the amber light will also go out and the proportioner will be turned on. The red low level warning light will not come on again until the fuel level in the fuselage tank is below the low level float switch in the fuselage tank.

CAUTION

Extended operation above 95% rpm at low altitude may result in premature actuation of the low level warning light. Temporarily retarding the throttles to allow the fuel proportioner to exceed engine fuel requirements will correct the situation.

3. If an electrical failure in the proportioner pumps circuit occurs, the fuel system will automatically convert to gravity feed when the fuel level in the fuselage tank descends to the low level float switch and the red low level warning and amber gravity feed light on the annunciator panel will come on. The red low level warning light will go out as the fuel level rises above the low level float switch.

Note

In the event of fuel system malfunction, check the fuel quantity to determine fuel on board.

4. A complete loss of electrical power will automatically convert the fuel system to gravity feed, but the red low level warning light or the amber gravity feed light cannot be illuminated, because of the loss of electrical power.

5. If the high level float switch fails to shutoff the fuel proportioner pumps, excess fuel will be pumped overboard through the fuselage tank vent valve to prevent fuselage fuel tank rupture.

Note

If an excessive drop in fuel quantity is indicated on the fuel quantity indicator (40 to 50%) it is possible the high level float switch is malfunctioning and fuel is being pumped overboard through the fuselage tank vent valve. The fuel system switch should be positioned to GRAVITY and the fuel quantity indicator monitored for a normal drop in fuel quantity the remainder of the flight. The malfunction should be entered in Form 781 and the high level float switch checked prior to the next flight.

External Fuel Management

External fuel can only be monitored by time and the indicator lights. Fuel from the drop tanks is drawn by the proportioner pumps to the fuselage tanks. Time should be noted when auxiliary fuel is selected and the Pylon Tank Fmpty light on the annunciator panel monitored. Lapse time will be the only indication that all the fuel has been drawn from the drop tanks, when the indicator light illuminates.

Tip tank fuel is pumped by the tip tank pumps to the wing fuel cells. When pressure buildup is sufficient to cause the light to go out, tip fuel is then being transferred. When the pressure drops the light will then illuminate and tips will be empty. Time will help to determine rate of use and amount, provided wing fuel has been low enough to prevent recirculation through the vent back into the tip tank.

Fuel Unbalance

Unbalance in wing fuel quantities may result due to improper refueling on the ground when the lateral attitude of the aircraft is sloping (due to ramp, unequal shock struts, etc.). Wing fuel quantities should be checked for balance prior to takeoff. Fuel unbalance because of improper fueling may not be noticed until approximately 10 minutes after takeoff because of unsensed fuel in the tanks. In order to insure an accurate check of wing fuel quantity make the balance check after 2 to 3 minutes of straight and level coordinated flight. An unbalance of 160 pounds can exist with no malfunction of the system. If at any time an unbalance greater than 160 pounds is detected in flight, the fuel system switch should be placed in the GRAVITY position. Slipping the aircraft toward the light fuel tank will help move fuel to the fuselage fuel tank. Fuel should be checked at frequent intervals to ascertain if placing the fuel system switch in the GRAVITY position is having remedial effect. A landing should be made as soon as possible if fuel unbalance is becoming more pronounced. Although the aircraft can easily be controlled, the increasing unbalance indicates a malfunction and aircraft should be landed, and the condition noted in Form 781.

Note

- A wing heavy condition should be anticipated in the traffic pattern; however, full control of the aircraft can be maintained.
- If fuel quantity remaining in either wing tank does not decrease, that fuel may be trapped in the wing cells. Note the amount of fuel in that tank and subtract it from the total fuel on board to determine usable fuel remaining.

Single Engine Cruise

Refer to Appendix I for single engine cruise data.

1. Throttle - CUT-OFF (for desired engine shutdown).
2. Retrim - AS DESIRED.

For single engine cruise, fuel management is the same as normal cruise; however, when using tip fuel, monitor wing fuel level. When a steady high level is indicated shutoff tip transfer switches, and allow the fuel level to decrease. This prevents the tip pump from recirculating wing and tip fuel, and lengthens pump life.

Leave the "T" handle in the PUSH-ON position to allow for fuel control, fuel cooling in the shutdown windmilling engine.

AIRSTART

Following is the procedure to be accomplished when airstarting a dead engine.

1. Throttle - OFF.

Note

Use copilot's throttles when attempting a restart in order to have cut-off feature available.

CAUTION

Prior to attempting an airstart observe tachometer for engine windmilling. If there is no indication of windmilling, the engine may have seized and no attempt should be made to restart until a windmilling indication is noted.

2. Fuel shutoff "T" handle - PUSH-ON.
3. Starter switch - AIR (momentarily).

WARNING

Do not position the battery switch to series start during airstart: this will cause the battery overvoltage relay to trip and result in the loss of battery power.

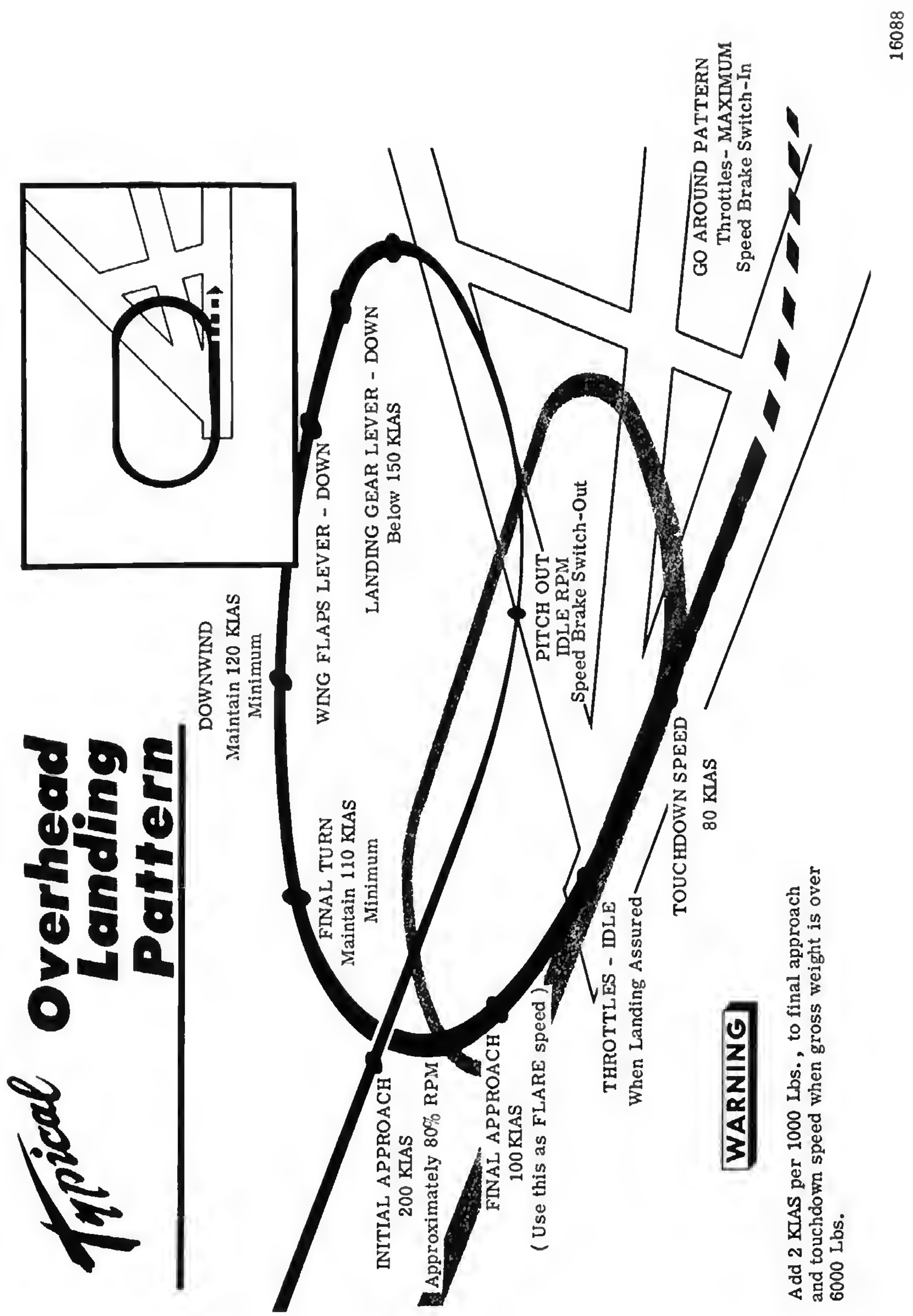

Typical Overhead Landing Pattern
DOWNWIND
Maintain 120 KIAS
Minimum
WING FLAPS LEVER - DOWN
LANDING GEAR LEVER - DOWN
Below 150 KIAS
PITCH OUT
IDLE RPM
Speed Brake Switch-Out
GO AROUND PATTERN
Throttles- MAXIMUM
Speed Brake Switch-In
16088
FINAL TURN
Maintain 110 KIAS
Minimum
TOUCHDOWN SPEED
80 KIAS
THROTTLES - IDLE
When Landing Assured
INITIAL APPROACH
200 KIAS
Approximately 80% RPM
FINAL APPROACH
100 KIAS
(Use this as FLARE speed)
WARNING
Add 2 KIAS per 1000 Lbs., to final approach and touchdown speed when gross weight is over 6000 Lbs.

Figure 2-4

4. Throttle - IDLE.
5. Exhaust gas temperature - MONITOR.
   The first indication of a start is a rise in exhaust gas temperature.

CAUTION

If the exhaust gas temperature exceeds the instantaneous limit for starting (refer to Section V), move the throttle to Cut-Off position and attempt another start if warranted.

6. Engine instruments - CHECK.

FLIGHT CHARACTERISTICS

Refer to Section VI for information regarding flight characteristics of the aircraft.

DESCENT

Refer to Appendix I for data concerning descents from various altitudes. Power settings, speed brake and thrust attenuator position depend on the performance desired. Any speed brake and power settings may be used during the descent, providing the airspeed limitations in Section V are not exceeded.

1. Altimeter - SET.
2. Defrost knob - AS REQUIRED.
   Rapid descents may cause fogging inside the canopy. Therefore, it is necessary that the canopy and windshield be kept as warm as possible to maintain proper visibility.
3. Pitot heat switch - AS REQUIRED.
4. 10, 000 feet check:
   a. Zero-delay lanyard - CONNECT; prior to initial penetration fix for descent or at 10, 000 feet MSL or 2, 000 feet AGL.
   b. Oxygen diluter lever - AS REQUIRED.
   c. Yaw damper switch - OFF.
   d. Fuel quantity - CHECK.
   e. All armament panel switches - OFF.

BEFORE LANDING

APPROACH TO FIELD

During the approach to the field and before entering the traffic pattern, perform the following checks:

1. Hydraulic pressure - CHECK
2. Engine inlet screen switch - AUTO.
3. Speed brake switch - AS REQUIRED.

INITIAL APPROACH

1. Airspeed - 200 KIAS.

180° TURN TO DOWNWIND LEG

1. Speed brake switch - OUT.
2. As bank is established for the 180° turn to downwind, reduce throttles to IDLE RPM.

DOWNWIND LEG

Maintain altitude on downwind leg while reducing airspeed and perform the following:

1. Gear lever - DOWN below 150 KIAS.
2. Gear position indicators - CHECK.
   a. Gear position indicator lights.
   b. Gear warning lights.
   c. Audio tone signal.

Maintain altitude and 120 KIAS until starting final turn.

3. Flap lever - DOWN below 150 KIAS.

FINAL TURN

1. Airspeed - 110 KIAS (minimum).

WARNING

Add 2 KIAS per 1000 pounds, to final approach and touch down speed when gross weight is over 6000 pounds.

FINAL APPROACH

1. Airspeed 100 KIAS (minimum 6000 pounds gross weight).
2. Landing lights - AS REQUIRED.
3. Throttles - IDLE (when landing is assured).
   Pattern should be planned so that a minimum of 50% RPM will be used on final approach.

NORMAL LANDING

1. Throttles - IDLE (when landing is assured).
   Pattern should be planned so that a minimum of 50% RPM will be used on final approach.

Note

At 6000 pounds gross weight or more add 2 KIAS per 1000 pounds.

2. Flap handle - UP after touchdown.
3. Nose wheel steering - ENGAGE.

Note

To avoid excessive swerve, neutralize the rudder prior to engaging nose wheel steering.

Refer to figure 2-4 for typical overhead landing pattern and recommended procedure. Refer to Appendix I for recommended approach and touchdown

speeds for varying gross weights, wind conditions, and configurations.

On final approach use wing-low technique for cross-winds in order to maintain runway alignment. If strong crosswinds are encountered, increase final approach speed 5 to 10 knots. Just before reaching the end of the runway, start the roundout by smoothly establishing a nose-high attitude. Continue to maintain the wing-low attitude for crosswind. This will require increased control deflections as airspeed decreases during the roundout. Plan touchdown at recommended main gear touchdown speed. (See Appendix I.) Touchdown on the main wheels in a nose-high attitude.

If crosswinds are not significant, maintain a nose-high attitude after touchdown to take advantage of aerodynamic braking. This will require increasing back stick pressure as airspeed dissipates. Leave flaps down and speed brake and thrust attenuators extended to take advantage of increased drag and reduced thrust. Lower the nose wheel to the runway while there is still sufficient elevator control to avoid damage to the aircraft and raise the speed brake. Use wheel brakes as necessary to stop on the remaining runway.

The aircraft weathervanes when landing in strong crosswinds. Lower the nose to the runway as soon as possible after touchdown and use nose wheel steering, rudder, and brakes if necessary to maintain directional control. Continue to maintain ailerons deflected into the wind during the landing roll.

If a high gust wind condition is encountered, half flaps should be used in the pattern, and final approach speed should be increased 5 to 10 knots.

NO FLAP LANDING

The procedure for landing without flaps is the same as for normal landing. Plan a longer final approach (normally a minimum of one mile), increase final approach airspeed by 10 knots, and expect an extended flare and longer landing roll.

Use normal landing procedure. Add 10 KIAS around the pattern. The -2 KIAS per 1000 pounds is also applicable.

BRAKING PROCEDURES

Wheel brake effectiveness increases as forward speed decreases. On landing, use wheel brakes only as required to decelerate the aircraft to normal taxi speed on the remaining runway. If maximum braking is required after touchdown, lower the nose wheel to the runway and raise the flaps. This will decrease lift and put more weight on the main wheels for increased friction. Use a single smooth application of brakes with constantly increasing pedal pressure. Optimum braking is achieved when maximum aircraft weight is on the main wheels and a very slight skid is maintained (approximately 15-20% rolling skid). Braking action decreases if a wheel is locked and the tire is in an excessive skid. If a skid results, brake pressure must be released and then reapplied to achieve normal braking action. Braking effectiveness can be increased by pulling back on the stick just short of raising the nose wheel.

Note

> Brakes, themselves, can merely stop the wheels from turning, but stopping the aircraft is dependent on the friction of the tires on the runway.

WARNING

> If maximum braking is used, aircraft should not be taxiied into a congested area. Peak temperatures occur in the wheel and brake assembly ten to fifteen minutes after maximum braking operation. This could result in brake failure or possible fire or explosion. Insure all personnel remain clear of the main wheels until they have cooled.

USE OF WHEEL BRAKES

To reduce maintenance difficulties and accidents due to wheel brake failure, brakes should be treated with respect. The most common mistakes that reduce brake life and reliability are stopping the aircraft as quickly as possible; use of brakes consistently for taxiing turns; and dragging brakes while taxiing. When applying brakes, there may be a slight time delay between the pedal release and the release of braking action. To minimize brake wear, the following precautions should be observed insofar as is practicable.

1. Use extreme care when applying brakes immediately after touchdown or at any time when there is considerable lift on the wings to prevent skidding the tires and causing flat spots. A heavy braking pressure can result in locking the wheels, if brakes are applied immediately after touchdown than if the same pressure is applied after the full weight of the aircraft is on the wheels. A wheel locked will not unlock as the load is increased as long as brake pressure is maintained.
2. If maximum braking is required after touchdown, lift should first be decreased by raising the flaps and dropping the nose before applying brakes.
3. For short landing rolls, a single, smooth application of the brake with constantly increasing pedal pressure is most desirable.
4. If brakes have been used on landing roll it is recommended that a minimum of six minutes elapse between landings where the landing gear remains extended in the airstream, and a minimum of 10 minutes between landings where the landing gear has been retracted to allow sufficient time for cooling between brake applications.
5. The full landing roll should be utilized to take advantage of aerodynamic braking and to use the brakes as little as possible.

6. After the brakes have been used excessively for an emergency stop and are in the heated condition, the aircraft should not be taxiied into a congested parking area or the parking brakes set.

STRAIGHT-IN APPROACH

When a straight-in approach is required, proceed as follows: Enter from outside the normal traffic pattern at 500 feet above the terrain and at the airspeed required for the situation (i. e. 200 KIAS for normal conditions, 120-130 KIAS for a nose access door malfunction, etc.). At least 3 miles from the end of the runway, reduce speed to below 150 KIAS, if necessary, by reducing throttles to IDLE rpm and lowering speed brake, and lower the landing gear. As the normal glide path is approached, lower flaps if required, adjust throttles, and continue as in a normal final approach.

LANDING ON SLIPPERY RUNWAYS

Touchdowns should be planned close to the approach end of the runway in order to utilize all the available runway length. Use recommended pattern and touchdown speeds since excessive landing speeds will result in longer stopping distance. Use aerodynamic braking as much as possible. Use brakes lightly, applying pedal pressure evenly and slowly. If brakes are applied hard and suddenly a skid will result. Use nose wheel steering primarily for directional control. Differential braking may be used to aid in directional control unless it results in skidding. If skidding occurs, reduce or release brake pedal pressure and use nose wheel steering for directional control. Landing roll distances will be considerably increased over the minimum for a dry runway, but since maximum braking is seldom required in normal operation, the distances will not normally appear excessive.

PORPOISING

CAUTION

Avoid landing on the nose wheel first or porpoising may result.

Porpoising is a condition encountered during landing, wherein the aircraft bounces back and forth between the nose wheel and the main gear after initial ground contact. This porpoising condition is caused by an incorrect landing attitude upon touchdown, which brings the nose wheel in contact with the runway before the main gear touches down. This condition most likely will occur when landing is attempted with an incorrect landing attitude and at an excessive airspeed. If immediate corrective action is not initiated, the porpoise will progress to a violent, unstable oscillation of the aircraft about the lateral axis. These repeated heavy impacts of the aircraft on the runway ultimately will result in structural damage to the landing gear and airframe. Therefore, a proper landing attitude immediately prior to touchdown is imperative to preclude the occurence of the porpoise. If porpoising should be encountered, immediately reposition the controls (stick NEUTRAL or slightly aft) to establish the normal landing attitude. Maintain this attitude and simultaneously advance throttles to 100% rpm. Do not attempt to counteract each bounce with opposite stick movement, because the combined reaction time of pilot and aircraft is such that the cited control movement will aggravate the porpoising action. Repositioning and holding the controls (restricting movement) will dampen out the oscillation. The addition of power will increase control effectiveness by increasing airspeed and permit the aircraft to become safely airborne once again and eliminate further porpoising.

Note

Directional control may be difficult to maintain if uneven engine acceleration occurs when throttles are advanced or when a crosswind exists.

TOUCH AND GO LANDING

1. Normal touchdown.
2. Throttles - MAXIMUM.
3. Speed brake switch - IN.
4. Trim - READJUST.
5. Gear lever - UP. (110 KIAS minimum)
6. Flap handle - UP.

GO-AROUND

1. Throttles - MAXIMUM.

Note

- Decide early in the approach if it is necessary to go-around and start go-around before too low an altitude and airspeed is reached.
- One engine may accelerate slightly faster than the other and care should be taken to control the yaw that may occur.
- On single engine go-around acceleration will be slightly slower.

2. Speed brake switch - IN.
3. Gear lever - UP. (110 KIAS minimum)

CAUTION

Do not raise the landing gear until definitely airborne.

4. Flap handle - UP.

GO-AROUND WITH ONE ENGINE INOPERATIVE

1. Throttle - AS REQUIRED.
2. Speed brake switch - IN.
3. Wing flap handle - UP. (110 KIAS minimum)

4. Landing gear lever - UP. (110 KIAS minimum) Raise the landing gear only after you ascertain that touchdown will not occur. Acceleration will be better with 1/2 flaps or no flaps.

AFTER LANDING

1. Flap handle - UP.
2. Canopy - AS DESIRED. Stow all loose items prior to opening canopy.
3. Engine inlet screens - CHECK EXTENDED.
4. Anti-collision beacon switch - OFF.
5. IFF and Nav aids - OFF.
6. Pitot heat switch - OFF.
7. Trim - NEUTRAL.

Note

It is permissible to shut one engine down to reduce taxi speed thereby reducing braking action and increasing brake life.

ENGINE SHUTDOWN

1. Fuel system switch - GRAVITY.
2. Speed brake switch - IN.
3. Throttles - OFF.
4. Fuel boost pump switch - OFF.
5. Inverter switch - OFF.
6. All electrical switches (except generators) - OFF.

BEFORE LEAVING AIRCRAFT

1. All switches - CHECK.
2. Cockpit vent valve - CLOSED.
3. Safety pins - INSTALLED.
4. Chocks - IN PLACE.

Note

- Be sure chocks are in place before releasing brakes.
- Do not set the parking brake after heavy braking. Heat generated may lock the brakes.

5. Flight controls - LOCK.

CAUTION

Make appropriate entries in Form 781 covering any limits in the Flight Manual that have been exceeded during the flight. Entries must also be made when in the pilot's judgement the aircraft has been exposed to unusual or excessive operations such as hard landing, excessive braking action during aborted takeoffs, long taxi runs at high speeds, etc.

Note

During cross-country flights, pilots are urged to maintain surveilance during oil tank servicing. Overfilling the oil tank will cause oil to be dumped overboard and cover the tail section of the aircraft. The oil level should be checked immediately after engine shutdown. After engine remains idle for a period of time, oil will drain into the engine lines, bearings, etc., and give a false low reading in the tank.

CHECKLIST

The normal abbreviated checklist is contained in T. O. 1A-37A-1CL-1.

TAKEOFF AND LANDING DATA CARD

The takeoff and landing data card is included in the Flight Crew Checklist. The takeoff and landing information for the planned mission should be entered on the data card and used as a ready reference for review prior to takeoff and landing. A complete sample problem of a mission, to familiarize the pilot with the use of the charts and procedures to fill out the takeoff and landing data card, is shown at the end of Appendix I, Part IX, Mission Planning.

Note

Pilots are not required to complete takeoff and landing data card if runway available is 4000 feet with pressure altitude not exceeding 5000 feet.

SECTION III

EMERGENCY PROCEDURES

TABLE OF CONTENTS

INTRODUCTION

This section includes procedures to be followed to correct an emergency condition. The procedures, if followed, will insure safety of the pilots and aircraft until a safe landing is made or other appropriate action is accomplished. Multiple emergencies, adverse weather, and other peculiar conditions may require modification of these procedures. Therefore, it is essential that pilots determine the correct course of action by use of common sense and sound judgement. Procedures appearing in bold face capital letters are considered critical action. Procedures appearing in small letters are considered noncritical action. Each is defined as follows:

CRITICAL ACTION

Those actions which must be performed immediately if the emergency is not to be aggravated, and injury or damage are to be avoided. These critical steps will be committed to memory.

NONCRITICAL ACTION

Those actions which contribute to an orderly sequence of events, assure that all corollary preparations are made prior to initiating the critical emergency action.

To assist the pilot when an emergency occurs, three basic rules are established which apply to most emergencies occurring while airborne. They should be remembered by each pilot. The rules follow:

1. Maintain aircraft control.
2. Analyze the situation and take proper action.
3. Land as soon as practicable.

GROUND OPERATIONS

ENGINF FIRE DURING START

If a fire warning light illuminates during an engine start, or if there are visual indications of fire existing in the engine nacelles, proceed as follows:

1. THROTTLES - OFF.
2. IGNITION AND STARTER SWITCHES, OR OPPOSITE GENERATOR - OFF.
3. BATTFRY SWITCH - OFF (APU DISCONNECTFD IF USED).

TAKEOFF

ABORT

If an abort on takeoff is necessary due to engine failure, fire or other unsafe condition, accomplish the following:

1. THROTTLES - IDLE (OFF FOR A MALFUNCTIONING ENGINE).

Note

Cut-off both engines if stopping distance is marginal.

2. GEAR LEVER - DOWN.
3. EXTERNAL STORES - JETTISON (AS NECESSARY).
4. Brakes - AS REQUIRED.
5. Fuel shutoff "T" handle (affected engine) - PULL OFF.

Note

To afford protection against explosion, heat or fire, the canopy should be retained during aborted takeoff. After the abort, normal canopy opening should be attempted prior to jettisoning the canopy.

WARNING

Avoid contacting raised barriers. With canopy open webbing will possibly enter cockpit and cause pilot injury. With canopy closed, webbing can jam the canopy closed.

Note

In the event of imminent contact with obstruction during landing or takeoff roll or other ground operations, the aircraft is capable of extremely short radius turns even at fairly high speeds with differential braking. Nose wheel steering is not available with both engines inoperative.

LANDING GEAR EMERGENCY RETRACTION

As a last resort, if it is necessary to retract the landing gear while the aircraft is on the ground, proceed as follows:

1. PRESS LANDING GEAR EMERGENCY OVERRIDE SWITCH AND SIMULTANEOUSLY MOVE THE LANDING GEAR LEVER TO THE UP POSITION. (SEE FIGURE 1-6.)

Note

Use only if stopping distance is critical, then only as a last resort.

If nose gear torque link is broken, normal gear retraction will not occur. Subsequent use of override switch to effect retraction may cause nose wheel to bind in wheel well.

CAUTION

- The landing gear will retract only if hydraulic pressure and electrical power are available.
- Do not use emergency override switch to raise landing gear lever in flight. Leave the gear down.

ONE ENGINE FAILURE/FIRE DURING TAKEOFF (AFTER AIRBORNE)

If an engine fails immediately after takeoff, the decision to continue depends upon airspeed, altitude, and length of runway remaining. If the decision is made to abort, check landing gear down, land the aircraft and follow ABORT procedures. If the decision is made to continue, it is imperative that the gear and flaps be raised as soon as possible. Rate-of-climb with one engine inoperative will be slower, depending on such conditions as air density, gross weight, and configuration. Proceed as follows:

If decision to stop is made:

1. FOLLOW ABORT PROCEDURE

If takeoff is continued:
1. THROTTLE (OPERATING ENGINE) - MAXIMUM.
2. EXTERNAL STORES - JETTISON (AS NECESSARY).
3. CLIMB TO MINIMUM SAFE EJECTION ALTITUDE.
4. CHECK FOR FIRE.
5. IF ON FIRE - EJECT.

If fire cannot be confirmed:

6. Throttle (affected engine) - OFF.
7. Land as soon as possible.

FLIGHT CHARACTERISTICS UNDER PARTIAL POWER CONDITIONS

Single engine operation in this aircraft introduces a small amount of yaw and out-of-trim effect because both engines are mounted close to the center of the aircraft. Aircraft flight controls provide adequate directional control during single engine operation. Rudder trim may not be adequate to relieve all rudder force required to maintain wings-level constant-heading flight.

Note

- Retracting the landing gear and the inlet screens will increase the rate-of-climb approximately 150 feet per minute or greater.
- Best single engine climb speed for best angle-of- climb is 135 KIAS. Best single engine climb speed for best rate-of-climb is 160 KIAS at sea level. (Minus 1 knot per 1000 feet.)

TWO ENGINE FAILURE DURING TAKEOFF (AFTER AIRBORNE)

If both engines fail immediately after becoming airborne and altitude precludes the possibility of an airstart or ejection, maintain aircraft control and land straight ahead turning only as necessary to avoid obstructions. The following procedure should be used:

If decision to stop is made:

1. FOLLOW ABORT PROCEDURE.

If abort is impossible:

2. EXTERNAL STORES - JETTISON.
3. ZOOM, IF POSSIBLE AND EJECT.

Note

To afford protection against explosion, heat, or fire, the canopy should be retained during crash landing. After landing, normal canopy opening should be attempted prior to jettisoning the canopy.

IN-FLIGHT

ENGINE FAILURE

Engine failure can be detected by a sudden decrease in engine exhaust gas temperature accompanied by a sudden loss of thrust. Fluctuating rpm, fuel flow and exhaust gas temperature often precede engine failure. When time and altitude permit, airstarts can be successfully accomplished providing fuel supply to the engine is sufficient for normal operation, and no mechanical defects exist which make normal operation hazardous. The fuel flowmeter will provide a visual indication if fuel flow is steady or unstable.

Figure 3-1

ONE ENGINE FAILURE DURING FLIGHT

If an engine fails in flight, try to determine cause of failure before attempting to restart the engine and continue as follows:

Nonmechanical failure:

1. Throttle (affected engine) - OFF.
2. Attempt airstart.

If airstart attempt is unsuccessful or deemed inadvisable, proceed with single engine flight and land as soon as practicable using single engine landing procedures.

Mechanical failure or unsuccessful airstart:

1. Throttle (affected engine) - OFF.
2. Land as soon as practicable.

Refer to Appendix I for single engine performance data.

DOUBLE ENGINE FAILURE DURING FLIGHT

1. STARTER SWITCH (EITHER ENGINE) - AIR.

CAUTION

Ignition and starting crank is provided for 30 to 45 seconds. Electrical equipment may momentarily become inoperative.

2. FUEL SYSTEM SWITCH - GRAVITY.
3. If airstart is unsuccessful - attempt airstart on other engine.
4. If neither engine starts - make forced landing or EJECT.

Refer to forced landing or ejection procedure.

ENGINE FIRE

A steady red light in the center of either fuel shutoff "T" handle indicates fire in the corresponding engine.

Note

It is possible the warning system may malfunction and give an erroneous indication. If there is a fire condition, it is generally supported by other indications. Fire is generally accompanied by one or more of the following indications: Excessive exhaust gas temperature, erratic engine operation, roughness, fluctuating fuel flow, visual indications such as smoke in the cockpit or smoke trailing behind the aircraft. If the aircraft is being flown solo, the mirror on the right side can be used as an aid in detecting smoke from the right engine. Any time the warning lights illuminate, attempt to verify the condition by other indications before abandoning the aircraft.

ENGINE FIRE DURING FLIGHT

If a fire detect warning light illuminates during flight, proceed as follows:

1. THROTTLE (AFFECTED ENGINE) - OFF.
2. CHECK FOR FIRE.
3. IF ON FIRE - EJECT.
4. If fire cannot be confirmed - LAND ASAP.

If the warning light goes out and no evidence of fire exists, land as soon as practicable. Do not attempt to restart. After engine shutdown, attempt to verify the presence of fire by checking for other indications such as smoke in cockpit, nacelle smoke or smoke trailing behind the aircraft or verification from ground or another aircraft. If corrective action has not extinguished the fire, EJECT.

Note

If fire detect warning light extinguishes after remedial action, actuate test circuit to determine if circuit is still functional. If test circuit fails to illuminate light, continue investigation for actual fire.

ELECTRICAL FIRE

If fuselage, wing, or electrical fire occurs, turn off all electrical equipment. If fire continues out of control, EJECT if conditions permit.

1. BATTERY AND GENERATOR SWITCHES - OFF.
2. Land as soon as possible.

SMOKE AND FUME ELIMINATION

In the event smoke or fumes enter the cockpit during flight, the following procedure should be used:

1. OXYGEN - 100%.
2. Check for presence of fire.
3. Bleed air switches - OFF.
4. Battery and generator switches - OFF.

Note

Turn both the battery and generator switches OFF until it is determined the smoke is not caused by a short in the electrical system.

If smoke is severe and continued flight is anticipated, jettison canopy if necessary.

5. Cockpit air lever - OPEN.
6. Canopy - JETTISON (if necessary).
7. Land - AS SOON AS POSSIBLE.

CAUTION

Smoke may be encountered in the cockpit after negative "G" flights due to oil siphoning from the engine. A landing should be made as soon as practical in order to check the oil level and identify the source of the smoke.

MAXIMUM GLIDE

For the maximum distance this aircraft will glide with clean configuration, both engines windmilling, refer to figure 3-3. During descents from altitude at the airspeed necessary for maximum glide, engine windmilling speed will be below the required rpm necessary to maintain pressure in the hydraulic system. Hydraulic pressure may be increased by positioning the engine starter switch to the GND position.

EJECTION VS FORCED LANDING

Because of the many variables encountered, the final decision to attempt a flameout landing or to eject must remain with the pilot. It is impossible to establish a predetermined set of rules and instructions which would provide a ready-made decision applicable to all emergencies of this nature. The basic conditions listed below, combined with the pilot's analysis of the condition of the aircraft, type of emergency, and his proficiency are of prime importance in determining whether to attempt a flameout landing or to eject. These variables make a quick and accurate decision difficult. If the decision is made to eject, prior to ejection, if possible, the pilot should attempt to turn the aircraft toward an area where injury or damage to persons or property on the ground or water is least likely to occur. Before a decision is made to attempt a flameout landing, the following basic conditions should exist.

Note

The A-37A has the capability of positive control throughout its flight and glide characteristics since it contains no power actuated control surfaces.

1. Flameout landing should only be attempted by pilots who have satisfactorily completed simulated flameout approaches in the aircraft.
2. Weather, terrain, conditions and lighting conditions must be favorable. Cloud cover, visilility, turbulence, surface wind, etc., must not impede in any manner the establishment of proper flameout landing pattern.
3. Flameout landings should only be attempted when either a satisfactory "High Key" or "Low Key" position can be achieved.
4. If at anytime during the flameout approach, conditions do not appear ideal for successful completion of the landing, ejection should be accomplished. EJECT no later than the "Low Key" altitude.

AIRSTART ATTEMPTS DURING FLAMEOUT LANDING PATTERN

In the event of a double engine flameout:

1. Attempt to complete all airstart efforts before high key is reached so that full attention may be devoted to accomplishing a successful flameout landing.
2. If the circumstances of flameout have precluded conclusive airstart attempts prior to high key, further airstarts may be attempted but primary attention should be devoted to proper execution of the flameout landing.

FORCED LANDING (NO POWER)

In the event both engines flameout during flight and airstarts are unsuccessful or not deemed advisable and the pilot does not elect to eject, the following should be accomplished. See figure 3-2, Maximum Glide Distances, and figure 3-3, Typical Forced Landing Pattern.

1. Establish glide - 135 KIAS.
   The landing gear, wing flaps, and speed brake may be raised, if necessary, to increase maximum glide distance.
2. External load - JETTISON.
3. Tip fuel switches - DUMP.
4. Shoulder harness lever - LOCK.
5. Landing gear lever - DOWN.
   The landing gear should be lowered over the field or at high key. Airspeed 135 KIAS after landing gear is down.

Note

Emergency landings shall be made with landing gear extended. This also applies to overshooting or undershooting prepared runways when touchdowns cannot be avoided.

If helmet is equipped with a visor, the visor should be in the down position to decrease the possibility of injury.

For a simulated forced landing, lower speed brake and adjust throttles to 60% rpm. When landing gear is lowered, readjust throttles to 50% rpm.

The forced landing pattern should be planned as a no-flap pattern, as hydraulic pressure may not be available to lower flaps. To prevent landing long, if the engines are not seized, flaps may be lowered just prior to touchdown, by motoring an engine with the air start switch and increasing hydraulic pressure.

An airspeed of 135 KIAS during the forced landing pattern provides the optimum glide speed for that configuration. Any deviation from 135 KIAS will result in an increased rate of descent.

The base key to position can be adjusted to compensate for excess altitude in the pattern. If additional altitude must be lost, a slip is recommended. Full rudder deflection may be used.

WARNING

Retention of the canopy is recommended during a forced landing. It will afford protection against fire, smoke, flying objects, and barrier cables or wires. The inability to open the canopy by electrical means, manual means, or by jettisoning is remote. Normal canopy opening should be attempted before jettisoning.

CAUTION

Directional control must be maintained by use of wheel brake only, as nose wheel steering will not be available when making a forced landing with both engines inoperative.

SPINS

SPIN CHARACTERISTICS

The A-37A has three spin modes: erect normal, erect accelerated, and inverted. The primary characteristics of each mode is well defined; however, minor characteristics will vary depending on the fuel remaining and type of entry. Although these variations appear minor, they have a definite effect on recovery and, also, on the pilot's ability to recognize what kind of a spin exists.

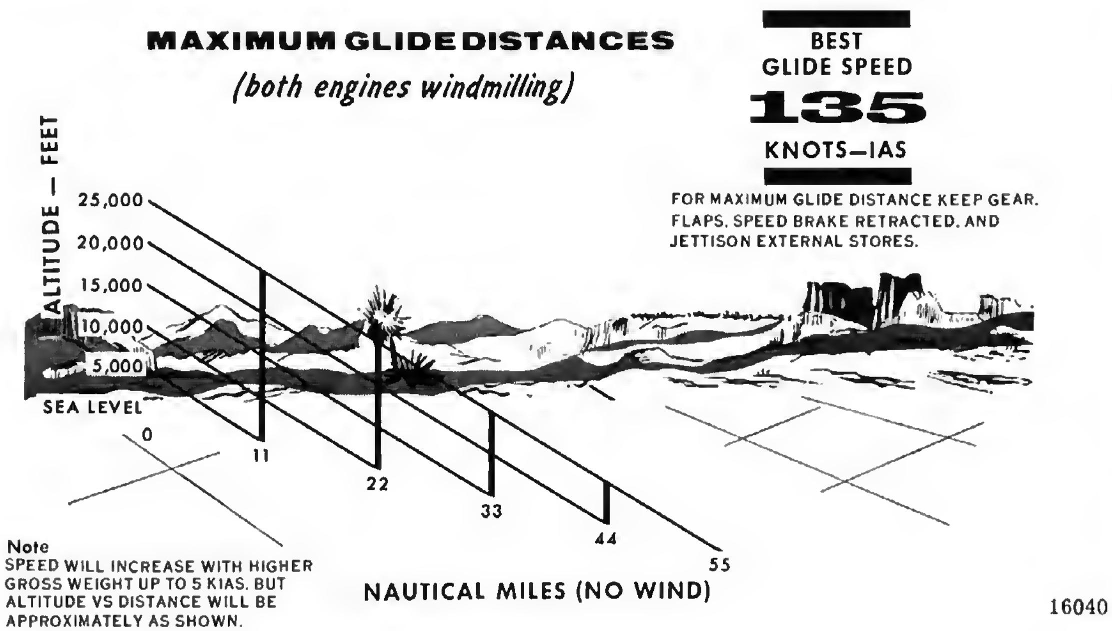


Figure 3-2

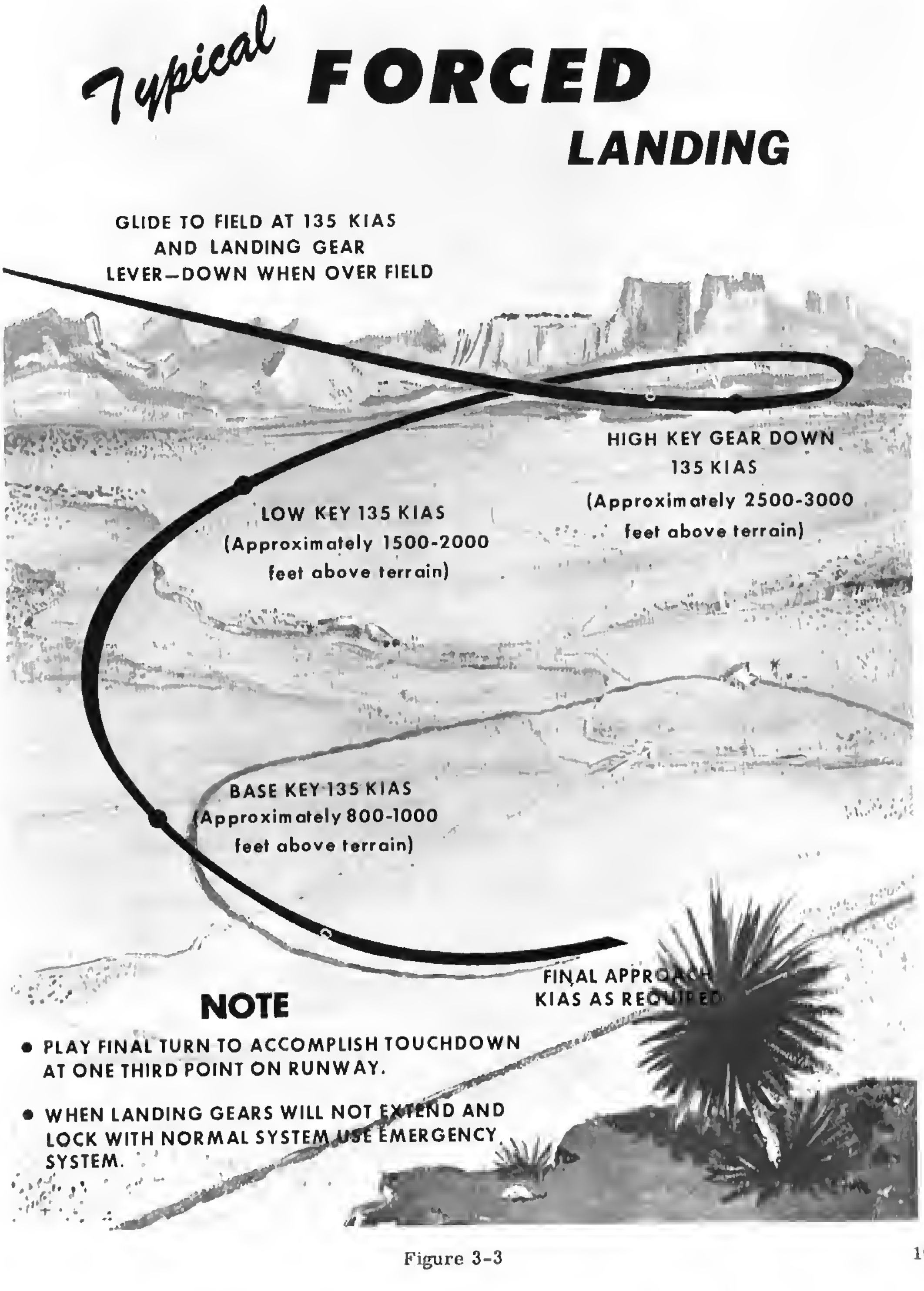


Figure 3-3

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NORMAL SPINS

The A-37A will spin in either direction, from 1.0G stall approach or from accelerated entry conditions by applying full back stick and full rudder in the direction of the desired spin. Spin entry is not violent in any manner, but will vary depending on the pitch attitude at time of stall (the higher the pitch attitude, the slower the spin entry) and with gross weight (the higher the gross weight, the slower the entry). This is not to imply that the aircraft is more reluctant to spin at higher gross weights.

The first turn of the spin is more like a roll with the nose dropping below the horizon in the first half and then above the horizon in the last half. Succeeding turns will cause the nose to progressively drop below the horizon and finally stabilize at about -30° pitch attitude. Gross weight and type of entry will vary the number of turns to stabilize. The left spin is more oscillatory and takes slightly longer to stabilize than does the right spin. Once the aircraft has entered a stabilized spin the altitude loss is approximately 500 feet per turn, completing a full turn in about three seconds. The aircraft will spin at different rates, depending on the amount of fuel on board. Also, an unbalanced fuel condition can be noticed by aircraft oscillation and varying yaw rates during one revolution. The heavier the aircraft, the slower the spin rate and vice versa. Accelerated entries in general, take longer to stabilize. At very low fuel remaining, the spin tends to be initially flat and the nose may remain above the horizon for as long as three turns.

ACCELERATED SPINS

The accelerated spin is caused by placing the elevator control in some position other than full back stick. The highest rotation rate is encountered with the stick full forward and rudder opposite to the direction of rotation. This maneuver is difficult to perform as the controls must be moved abnormally slow, requiring a minimum of four seconds to full deflection. If controls are moved too fast, the aircraft will recover. The accelerated spin is characterized by lowering of the nose and increasing rate of rotation. As the spin progresses from normal to the accelerated condition, lateral accelerations will be felt and the aircraft will whip as the rate of rotation increases. A new stabilized rotation rate is reached shortly after the accelerated control position is established.

INVERTED SPINS

With the aircraft spinning inverted, neutralize rudder and move the stick full aft. A rapid and positive recovery will occur within one-half turn. The aircraft rolls rapidly into an erect stalled condition and rotation stops within one-half turn. When rotation has definitely stopped, ease forward on the stick and break the stall. The aircraft can be held in the stalled condition for prolonged periods of time; however, if it is held in the stall long enough, it may eventually fall into a normal spin. Although the recovery is very abrupt, it is not excessively violent and is well within the structural limits of the aircraft.

Landing configuration spins are not recommended as practice maneuvers; however, if entered inadvertently, use the normal single recovery procedure.

CAUTION

If a landing configuration spin is entered inadvertently, both gear and flaps should be retracted as soon as possible after recovery to prevent excessive structural loads.

SPIN RECOVERY

Single Spin Recovery

One procedure which will recover the aircraft from any spin under all conditions:

1. THROTTLES - IDLE.
2. RUDDER AND AILERONS - NEUTRAL.
3. STICK - ABRUPTLY MOVE FULL AFT AND HOLD.
   a. If the spin is inverted, a rapid and positive recovery will be affected within one-half turn.
   b. If the spinning stops, neutralize controls and recover from the ensuing dive.

If the spinning continues, the aircraft must be in an erect normal spin (it cannot spin inverted or accelerated with the controls held in this position). Determine the direction of rotation and proceed with the following steps:

4. RUDDER - ABRUPTLY APPLY FULL RUDDER OPPOSITE TO THE DIRECTION OF SPIN AND HOLD.
5. STICK - ONE TURN AFTER APPLYING RUDDER, ABRUPTLY MOVE THE STICK FULL FORWARD.
   a. As the nose pitches down, relax forward pressure while continuing to hold rudder until spinning has stopped. Do not allow the stick to move aft of neutral until recovery is effected.
   b. Recovery should be accomplished within one and one-half turns from the point at which recovery rudder was applied.

Note

If forward stick is applied before rudder effectiveness is obtained, the spin will momentarily speed up and recovery will take slightly longer.

WARNING

One of the major reasons for missing a recovery is not waiting long enough after the recovery controls have been initiated.

6. CONTROLS - NEUTRAL AFTER SPINNING STOPS AND RECOVER FROM THE ENSUING DIVE.

Note

It is not necessary to relax the forward pressure after the nose pitches down in order to effect recovery; however, if the stick is held forward, the aircraft attitude upon recovery can be past the vertical. In this position, the aircraft will transition into an inverted spin unless controls are neutralized immediately.

WARNING

The characteristics of the spin and the effectiveness of the recovery procedure will vary: (1) If the stick is not held full aft with rudder neutral during the spin; (2) If the aircraft is spun with over 70 pounds asymmetric wing fuel; (3) If the application of recovery controls is not executed briskly; (4) If the recovery procedure is varied so that less than full rudder or full-down elevator is obtained; (5) If forward stick is applied before rudder effectiveness is obtained.

SPIN RECOVERY CHARACTERISTICS

Recovery characteristics using the single recovery procedure are as follows:

Normal Spins

From an initial condition of stick aft and rudder in the direction of spin, the nose will lower slightly when the rudder is neutralized and, initially, the rotation rate will increase slightly; then as the neutral rudder becomes effective, the rotation rate will decrease slightly and remain constant. When rudder opposite to the direction is applied, the nose drops slightly and the apparent rotation rate will increase slightly. After approximately one-half turn, the apparent rotation rate will be constant or decreasing slightly; aircraft buffet may be apparent. Full rudder effectiveness will be developed by one full turn. As the forward stick is applied, the nose drops sharply and rotation will stop within one-fourth to one-half turn from this point. If the forward stick pressure is eased off as the nose pitches down, the dive angle will not become excessive.

Accelerated Spins

From any control position, neutralize the rudder and briskly move the stick full aft and hold. As the stick is moved full aft, the nose raises and the rotation rate will start to decrease. The decrease in rotation rate may not be immediately apparent; however, it should be emphasized that as soon as this control position has been established, the aircraft immediately transitions to a normal condition for recovery, i.e., a normal spin recovery (opposite rudder for one turn and forward stick) can then be made without further delay. Recovery will occur within one and one-half turns after opposite rudder is applied.

Inverted Spins

The inverted spin can occur from either an inverted stall condition or transitioning from an erect spin by using improper recover technique. The spin can be accelerated by allowing the controls to free float or by holding rudder in the direction of rotation and moving the stick aft. As with the erect accelerated spin the nose drops and rotation rate increases until a new stabilized rate is reached. A light fuel weight below 1,000 pounds remaining tends to prevent a spin from occurring from the inverted stall condition. However, entries out of an erect spin are not noticeably affected.

EJECTION

The following information should be observed when ejection must be accomplished. To eject follow the ejection procedure.

1. IFF - EMERGENCY.
2. Under level flight conditions, eject at least 2000 feet above the terrain whenever possible.

WARNING

Do not delay ejection below 2000 feet above the terrain in futile attempts to start the engine or for other reasons that may commit you to an unsafe ejection or a dangerous flameout landing. Accident statistics emphatically show a progressive decrease in successful ejections as altitude decreases below 2000 feet above the terrain.

3. Under spin or dive conditions, eject at least 10,000 feet above the terrain whenever possible.
4. Attempt to slow the aircraft as much as practical prior to ejection by trading airspeed for altitude.
   a. Below 120 KIAS, airflow is insufficient to affect rapid parachute deployment. Therefore, it becomes extremely important during low altitude ejection to obtain at least 120 KIAS, if possible, to assure more rapid parachute deployment.
   b. During high altitude ejection, observing this minimum airspeed (120 KIAS) becomes less important since time (altitude) for parachute deployment is a much less important factor.
5. If the aircraft is not controllable, ejection must be accomplished at whatever speed exists, as this offers the only opportunity for survival. At sea level wind blast will exert minor forces on the body up to about 525 KIAS.
6. The automatic safety belt must not be opened manually before ejection, regardless of altitude. If the automatic seat belt is opened manually, the automatic opening feature of the parachute is eliminated and seat separation may be too rapid at high speeds.

EJECTION PROCEDURE

BEFORE EJECTION IF TIME AND CONDITIONS PERMIT:

1. IFF - EMERGENCY.
2. Notify appropriate ground agency of ejection (include type of aircraft, number of occupants, location and altitude).
3. Stow all loose equipment.
4. Seat adjustment lever - LOCKED.
5. Actuate bailout oxygen bottle.
6. Attain proper airspeed, altitude and attitude.
7. Pull helmet visor down.

EJECTION

1. RAISE EITHER ARMING HANDLE.
2. Attain correct body position. Place feet firmly on floor, sit erect with head hard against headrest and chin tucked in.
3. SQUEEZE TRIGGER.
4. Immediately after ejection attempt to open seat belt.
5. RELEASE ARMING HANDLES AND KICK FREE.
6. Below 14, 000 feet, pull parachute rip cord handle.

AFTER EJECTION.

1. If above 14, 000 feet, pull parachute arming lanyard knob.
2. If below 14, 000 feet, pull parachute rip cord handle.

If automatic seat belt operates properly and parachute arming lanyard is connected, parachute will open one second after seat separation if below 14, 000 feet or at 14, 000 feet if ejection occurs above that altitude.

Note

If automatic seat belt fails, automatic features of parachute will be lost. Open seat belt manually.

Figure 3-4

Note

Improper routing of personal leads may cause inadvertent opening of the lap belt latch during ejection. Care must be taken to insure that flight clothing, such as sleeves, will not catch and release the lap belt during ejection.

LOW ALTITUDE EJECTION

During any low altitude ejection, the chances for successful ejection can be greatly increased by zooming the aircraft (if airspeed permits) to exchange airspeed for altitude. Ejection should be accomplished while the aircraft is in a positive climb. This will result in a more nearly vertical trajectory for the seat and crew member thus providing more altitude and time for seat separation and parachute deployment.

Emergency Minimum Ejection Altitudes

WARNING

Emergency minimum ejection altitudes quoted were determined through extensive flight test and are based on distance above terrain on initiation of seat ejection (i.e., time seat is fired). These figures do not provide any safety factor for such matters as equipment malfunction, delays in separating from the seat, etc. These figures are quoted only to show the minimum altitude above the terrain that must be achieved in the event of such low-altitude emergencies as fire on takeoff. They must not be used as the basis for delaying ejection when above 2000 feet, since accident statistics show a progressive decrease in successful ejections as altitude decreases below 2000 feet. Therefore, whenever possible, eject above 2000 feet. When ejecting under controlled conditions at more than 2000 feet above the ground disconnect the zero-delay lanyard. To insure survival during extremely low-altitude ejections, the automatic features of the equipment must be used and depended upon.

BA-15 or BA-18 Back Pack/C-9 Canopy.

1. With F-1B Timer (1 Second Parachute) 200 Feet.
2. With Zero-Delay Lanyard Connected to Parachute Rip cord Handle (0 Second Parachute) 100 Feet.

ZERO-DELAY LANYARD CONNECTION REQUIREMENTS

The zero-delay parachute lanyard will be connected and disconnected as follows:

1. Connect prior to takeoff.
2. Leave connected at all times below 10,000 feet pressure altitude including flights in which 10,000 feet may be temporarily exceeded.

Note

If operating above terrain over 8000 feet high, the zero-delay lanyard should remain connected until the aircraft is at least 2000 feet AGL over the terrain during enroute descent.

3. Disconnect when passing through 10,000 feet pressure altitude when this altitude will be exceeded for prolonged periods.
4. Connect prior to initial penetration, or at 10,000 feet pressure altitude during enroute descent.

EJECTION IF CANOPY FAILS TO JETTISON

If the canopy does not jettison when the seat arming handles are raised, an attempt should be made to release the canopy by pulling the canopy jettison "T" handle, or positioning the canopy downlock lever in the UNLOCKED position and attempt to raise canopy by pulling the canopy de-clutch handle. If the canopy cannot be jettisoned by any of the above procedures, the seat can be ejected through the canopy; this should be a last resort method and should only be attempted after all manual or electrical attempts at opening the canopy have failed.

BAILOUT IF SEAT FAILS TO EJECT

If ejection seat fails to eject when the trigger in the right arming handle is squeezed, a manual bailout will be required. Proceed as follows:

1. BAILOUT BOTTLE - ACTUATE.
2. PERSONAL EQUIPMENT LEADS - DISCONNECT.
3. TRIM - NOSE-DOWN.
4. INVERT AIRCRAFT.
5. SAFETY BELT - UNFASTEN AND RELEASE STICK
6. PARACHUTE ARMING LANYARD OR D-RING - PULL.
7. If aircraft is not controllable, bailout by diving over the trailing edge of the wing.

WARNING

After canopy has been jettisoned, purposely or otherwise, and seat ejection has not been accomplished, no attempt should be made to place the arming handles back down. The arming handles are held in the up position by means of a mechanical lock. In the event of damaged firing devices, any movement of the arming handles or trigger might jettison the seat with possible injury to the person attempting such action.

STRUCTURAL DAMAGE

If structural damage occurs in flight, the pilot must decide whether to leave the aircraft or attempt a landing. If aircraft is controllable, proceed as follows:

1. Climb to 10,000 feet above terrain.

2. Simulate a landing approach (normally a straight-in approach).
3. Determine airspeed at which aircraft becomes difficult to control.

Note

If aircraft becomes difficult to control or approaches a stall, lower the nose and increase power for recovery. In no case allow airspeed to decrease below 100 KIAS. Maximum recommended airspeed for landing is 130 KIAS with no flaps.

4. Abandon aircraft if not controllable at 130 KIAS or below.
5. Airspeed - 20 KIAS above minimum or controllable airspeed during descent and landing.
6. Traffic pattern - FLY a straight-in approach.

NOSE ACCESS DOOR OPENING IN-FLIGHT (HIGH AIRSPEED)

The opening of an unlatched or improperly adjusted nose access door is related to the angle of attack of the aircraft. Nose access door openings have occurred at high angle of attack with both low and high airspeeds. Openings have also occurred during takeoffs, approaches, and landings. If nose access door comes open at high airspeed:

1. THROTTLES - IDLE.
2. SPEED BRAKE SWITCH - OUT.
3. ESTABLISH LEVEL FLIGHT.

CAUTION

If nose access door opens at high airspeed, severe buffeting and structural damage may occur. The aircraft speed should be reduced as rapidly as possible without pulling G's as an increased angle of attack will cause the door to open wider.

If the door closes then begins to open again as speed is reduced:

4. Maintain an airspeed at which the door will remain closed.
5. Avoid any abrupt changes in pitch attitude.
6. Land as soon as practicable.
7. Final approach speed - 20 to 30 KIAS above normal.

Experience indicates that the door will probably begin to open at 120 to 130 KIAS as airspeed is decreased and will be fully open at 90 KIAS. Use a straight-in approach with gentle turns and smooth control techniques. Fly the aircraft down very close to the runway. Do not attempt to spike the aircraft on the runway and do not allow the aircraft to balloon.

ON TAKEOFF

If the nose access door opens on takeoff, the takeoff should be aborted if sufficient runway remains. If takeoff is continued, maintain an airspeed that will keep the door closed and land as soon as possible using procedures described above.

CANOPY UNLOCKED OR LOST DURING FLIGHT

If the canopy was not locked prior to takeoff, the canopy will begin to open shortly after takeoff, and may separate from the aircraft if airspeed is allowed to increase. If the canopy is lost, make a straight-in approach maintaining a minimum of 120 KIAS on final. If the canopy-not-locked warning lights is observed to be illuminated during flight, or it is obvious the canopy is not properly locked or opening during flight, the following procedure will apply:

1. Slow to 120 KIAS while avoiding abrupt pitch changes.

Note

Speed brake should not be lowered to reduce airspeed. Retard throttles slowly to reduce airspeed without making abrupt pitch changes.

WARNING

Avoid flying over populated areas.

2. Canopy control switch - EXTERNAL.

Note

The internal canopy control switch is inoperative unless the canopy downlock handle is in the UNLOCK position.

3. Land Immediately. Make a straight-in-approach. Maintain 120 KIAS, using shallow turns.

CAUTION

Do not touch canopy downlock handle until landing roll is completed.

RUNAWAY TRIM

1. Airspeed - 120 to 150 KIAS.
2. Attempt use of trim button on opposite control stick. If trim is regained, do not trim again unless the extreme condition recurs.

Note

- If the nose has pitched up to a dangerous attitude, add power and roll the aircraft into a banked attitude to bring the aircraft back to level flight.
- After the aircraft is under control, pull the applicable trim circuit breaker and turn battery and generator switches back on.
- If the trim tab fluctuates from stop to stop, accomplish the procedure for runaway trim and attempt to turn off battery and generator switches at a position as near neutral trim as possible.

LANDING

LANDING WITH ONE ENGINE INOPERATIVE

Single engine landings can be made using procedures similar to those used for two engine operation. Careful planning should be used to make the first attempt successful, since recovery from an aborted landing with single engine power requires more time and distance. Turns should be more shallow than normal. The normal overhead pattern should be flown. The speed brake should not be used until on final approach and landing is assured. The airspeed on final approach should be 110 KIAS minimum. At gross weights over 6,000 pounds add 2 KIAS per 1,000 pounds.

WARNING

When landing with one engine inoperative the time for actuating of hydraulic components will be noticeable longer due to single engine operation and reduced power.

CAUTION

If porpoising occurs upon touchdown, do not increase power on good engine because the unequal thrust will make directional control difficult. Position and hold controls to establish normal landing attitude. Do not attempt to counteract each bounce with opposite stick movement.

HYDRAULIC POWER SUPPLY SYSTEM FAILURE

Hydraulic system failure will be indicated by a loss of pressure on the hydraulic pressure indicator. As soon as hydraulic system failure is detected during flight, a landing should be made as soon as practicable. If a complete hydraulic failure occurs, the flaps, speed brake, spoilers, thrust attenuators, and nose wheel steering will be inoperative. Landing gear extension will have to be made by using the emergency air system.

LANDING GEAR EMERGENCY "T" HANDLE

Figure 3-5

1. Lower gear pneumatically.
2. Land as soon as practicable.

LANDING GEAR EMERGENCY EXTENSION

In case of a complete hydraulic system failure, the landing gear can be lowered with the emergency system as follows:

1. Airspeed - 150 KIAS or below.
2. Gear handle - DOWN.

Note

If landing gear lever will not lower, attain sufficient altitude and lower the lever while maintaining slight negative "G's".

3. Landing gear emergency "T" handle - TURN, PULL.

CAUTION

- Do not pull emergency landing gear "T" handle unless landing gear lever is in the down position. Damage to landing gear and aircraft may result.
- To prevent rupturing of the hydraulic reservoir, do not attempt to recycle landing gear after actuating emergency system. Rupturing of hydraulic reservoir could result in an in-flight fire.

4. Landing gear indicators - CHECK.

A malfunction of one of the main gear door sequencing switches could result in a main gear door opening and the landing gear remaining retracted. The affected landing gear may be extended by pulling the gear retract circuit breaker. Gear position indicators should be checked for a down and locked indication.

LANDING WITH ANY GEAR UP OR UNLOCKED

If a condition exists in which one or more landing gear remains up or indicates unlocked, make a straight-in approach with whatever landing gear can be extended or partially extended and proceed as follows:

1. Request runway be foamed, time permitting.

WARNING

If time permits, have runway foamed to reduce possible damage to the aircraft and fire hazard.

2. Armament - JETTISON.
3. Tip fuel switches - DUMP.
4. Retain external fuel tanks, if empty.
5. Seat arming handle safety pin - INSTALLED.
6. Shoulder harness - LOCK.
7. Speed brake switch - OUT.
8. Flap handle - DOWN.
9. If any gear is up or collapses - SHUTDOWN ENGINES.
10. Battery switch - OFF (if necessary).

Note

If possible do not turn battery off after aircraft stops because speed brake will retract and cause further damage.

11. Landing gear safety pins - INSTALLED.

WARNING

Retention of the canopy is recommended. It will afford protection against fire, smoke, flying objects, and barrier cables or wires. The inability to open the canopy by electrical means, manual means, or by jettisoning is remote. Normal canopy opening should be attempted before jettisoning.

Note

- If a nose gear malfunction occurs, holding it off the runway can be aided by trimming the elevator full nose down. Do not use brakes until the nose wheel is on the runway and then only as necessary to maintain directional control.
- If a main gear malfunction occurs, land on the side of the runway corresponding to the extended gear. Hold retracted or unlocked gear off as long as possible. Use brake on lowered gear and nose wheel steering to maintain directional control.

DITCHING

Eject rather than ditch this aircraft. All emergency survival equipment is carried by the pilot, consequently, there is no advantage of staying with the aircraft.

LANDING WITH A FLAT TIRE

If a flat tire occurs on takeoff with insufficient runway remaining to abort, leave landing gear extended and land as soon as practicable. If nose tire is flat, hold nose gear off the runway until just prior to losing elevator control. After touchdown, trim elevator full nose down to assist holding nose tire off runway. Use nose wheel steering and brakes for directional control. With one main tire flat, land on the side of the runway corresponding to the good tire. Use brakes and nose wheel steering for directional control.

ASYMMETRICAL FLAP CONDITION

Attempt to correct an asymmetrical flap condition by reversing the wing flap lever. If it is not possible to eliminate the asymmetrical flap condition, use rudder and ailerons as necessary to maintain aircraft control and land as soon as possible from a straight-in approach maintaining a minimum of 110 KIAS on final.

WHEEL BRAKE FAILURE

When making a landing with a wheel brake inoperative, land on the side of the runway corresponding to the inoperative brake.

Note

Each brake master cylinder is independent. In case of wheel brake failure (during dual flight) check both sets of brake pedals.

After touchdown, use nose wheel steering and the good brake to maintain directional control and stop the aircraft. If both wheel brakes fail, use maximum aerodynamic braking upon landing. Differential braking may be used for short radius turns into taxiways or other suitable areas if runway is of insufficient length. As a last resort, in the event of imminent contact with obstructions, press the emergency override switch and raise the landing gear lever to the UP position.

WARNING

Avoid contacting raised barriers.

EMERGENCY ENTRANCE

WARNING

WHEN JETTISONED. THE CANOPY WILL FALL IN THE IMMEDIATE AREA AFT OF THE AIRPLANE.

Figure 3-6

MISCELLANEOUS

FUEL BOOST PUMP WARNING LIGHT ON DURING FLIGHT

1. Do not perform negative G maneuvers.
2. If light remains on, land as soon as practicable.

If the fuel boost pump warning light illuminates during normal flight, do not perform negative G maneuvers. Land as soon as practicable.

Note

The fuel boost pump warning light may flicker momentarily near zero G conditions due to a momentary lack of fuel at the boost pump inlet.

GENERATOR FAILURE

If both generators fail or one generator fails, as indicated by the generator warning lights, and battery power is still available, turn off all non-essential electrical equipment to conserve battery.

1. Affected generator switch - OFF.
2. Land as soon as practicable.

INVERTER FAILURE

Inverter failure can be detected by observing the inverter out warning light. (See figure 1-6.) If the attitude indicator, J-2 directional indicator, fuel quantity gage, or fuel flowmeters cease to function, place the inverter switch in the SPARE position, and the warning light will go out.

COMPLETE ELECTRICAL FAILURE

Complete electrical failure is evidenced by a zero reading from both loadmeters and failure of all electrically operated equipment. This condition primarily arises bacause of failure of the generators. The battery will not support the heavy load required for normal flight. A frequent check of the loadmeter readings, especially during night flights is good insurance. The important things to remember are:

Lose:

1. All electrical indicators and warning systems will be inoperative.
2. Neither the lights nor any of the radios will operate.
3. Speed brake, spoilers, thrust attenuators and nose wheel steering cannot be operated.
4. Fuel system will automatically be on emergency gravity feed system.

5. Trim tabs will remain as set prior to electrical failure. A landing should be made as soon possible.
6. External load cannot be jettisoned or dropped without electrical power.

Retain:

1. Engine operation.
2. Flap operation.
3. Gravity fuel.
4. Emergency gear extension.

Note

With a complete electrical failure the flaps will be operative but the flap position indicator will be inoperative.

WARNING

Instrument flying is impossible, because all radio communication equipment and essential flight instruments will be inoperative.

HIGH LOADMETER READING

Continued operation at idle or battery engine starts may result in loadmeter reading above 0. 5. If one or both loadmeters show a reading above 0. 8 during first 10 minutes of flight or 0. 5 thereafter, proceed as follows:

1. Battery switch - OFF.
2. Loadmeter - CHECK.
   If loadmeter returns to normal, battery is faulty. Leave battery switch OFF and land as soon as possible.

If loadmeter remains high:

3. Inverter switch - SPARE.
4. Both generator switches - OFF.
5. All electrical equipment - OFF.
6. Monitor loadmeters while turning battery and generators ON. Turn each electrical accessory ON, one at a time, until faulty system is located. Turn defective unit OFF unless it is essential for flight, and land as soon as practicable.

Note

A high loadmeter reading usually results in battery failure, battery burning, battery explosion and/or complete electrical failure.

ZERO LOADMETER READING

If a loadmeter indicates a zero reading, proceed as follows:

1. Opposite generator switch - OFF.
2. Battery switch - OFF.
   If electrical accessories continue to operate, the loadmeter is inoperative.
3. Battery and opposite generator switch - ON, if loadmeter is inoperative and continue mission.
4. If accessories fail when battery and opposite generator switches are OFF, generator is inoperative.
5. Battery and opposite generator switch - ON, if generator in inoperative.
6. Land as soon as practicable.

ENGINE OIL SYSTEM FAILURE

If an oil system malfunctions (as evidenced by high or low oil pressure) has caused prolonged oil starvation of engine bearings, the result will be a progressive bearing failure and subsequent engine seizure. This progression of bearing failure starts slowly and will normally continue at a slow rate up to a certain point at which the progression of failure accelerates rapidly to complete bearing failure. The time interval from the moment of oil starvation to complete failure depends on such factors as: condition of the bearings prior to oil starvation, operating temperature of bearings, and bearing loads. A good possibility exists for 10 to 30 minutes of operation after experiencing a complete loss of lubricating oil. Bearing failure due to oil starvation is generally characterized by a rapidly increasing vibration. When the vibration becomes moderate to heavy, complete failure is only seconds away and in most instances the pilot will increase his chances of a successful ejection or single engine landing by shutting down the affected engine. Since the end result of oil starvation is engine seizure, the following procedures should be observed in an attempt to forestall engine seizure as long as possible. At first sustained indication of oil system malfunction:

1. Affected engine - SHUTDOWN IMMEDIATELY (conditions permitting).

SECTION IV

CREW DUTIES

CREW DUTIES

Crew duties are not applicable in this aircraft.

SECTION V

OPERATING LIMITATIONS

TABLE OF CONTENTS

OPERATING LIMITATIONS

This section includes aircraft and engine limitations which must be observed during normal operation. These limitations are derived from extensive wind tunnel and flight testing to insure your safety and to help obtain maximum utility from the equipment. The instrument dials are marked as shown in figure 5-1 as a constant reminder of airspeed and engine limitations; however, additional limitation on operational procedures, aerobatics, and aircraft loading are given in the following paragraphs.

MINIMUM CREW REQUIREMENTS

The minimum crew requirement for this aircraft is one pilot in the left seat.

INSTRUMENT MARKINGS

Cognizance must be taken of the instrument markings as shown in figure 5-1, since they represent limitations that are not necessarily repeated elsewhere in the text.

ENGINE LIMITATIONS

Engine limitations are shown in figure 5-1.

ENGINE RPM LIMITATIONS

100 ±1% rpm - limits for full throttle operation.
103% rpm - overspeed limit.

Flight conditions during climbs and dive may result in temporary rpm increases. When these conditions occur, however, throttles should be adjusted to maintain engine speeds below 100% rpm. Operation of the engine in excess of 103% rpm constitutes an engine overspeed. Appropriate entry will be made in Form 781, indicating highest rpm, exhaust gas temperature and duration (in seconds) of overspeed above 103% rpm.

EXCESSIVE ENGINE EXHAUST GAS TEMPERATURE

If temperature limits are exceeded in flight, the throttles should be adjusted immediately to maintain the exhaust gas temperature within limits. Whenever the operating limits are exceeded, make appropriate entry in Form 781, indicating highest rpm, exhaust gas temperature, and duration (in seconds of overtemperature condition).

FUEL FLOW FLUCTUATION LIMITATIONS

Fuel flow fluctuation of up to 100 pounds per hour when not accompanied by EGT or rpm fluctuations, are acceptable, providing the fluctuation ceases when the boost pump is momentarily turned off. Fuel flow fluctuation accompanied by EGT or rpm fluctuation or actual engine surge are not acceptable.

PROHIBITED MANEUVERS

The following maneuvers are prohibited:

1. Vertical whip stalls.
2. Snap rolls.
3. Spins.
4. Intentional fish tail type maneuver by repeated rudder reversal.
5. Maneuvers performed by trim alone.
6. Trimming in a dive at a speed within 20 knots of the limiting structural airspeed.
7. Inverted flight for more than 10 seconds.

Note

> Any maneuver resulting in prolonged negative acceleration will result in engine flameout. There is no means of insuring a continuous flow of fuel for more than 10 seconds in this attitude.

CENTER OF GRAVITY LIMITATIONS

The aircraft is always loaded so that any expenditure of load or shift in crew members will result in a center of gravity which is always within satisfactory limits. Refer to T. O. 1A-37A-5 for the current applicable operation restrictions.

WEIGHT LIMITATIONS

The maximum gross weight should not exceed 12, 000 pounds. Above this weight, structural failure may result if a load factor in excess of 5G's is obtained.

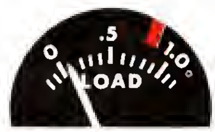
INSTRUMENT

The instrument setting is such that the maximum allowable airspeed pointer will move to indicate the limiting structural airspeed of 415 knots IAS or airspeed representing limiting Mach No. of .70 indicated whichever occurs first.

AIRSPEED

150 KIAS gear and flap-down limit airspeed

135 KIAS landing lights-down limit



LOADMETER

.8 maximum for takeoff

.5 Maximum after 10 minutes of flight

FUEL GRADE JP-4

TACHOMETER

48-98.5% rpm continuous operation

100% rpm maximum

HYDRAULIC PRESSURE

1250-1550 PSI normal

1750 PSI maximum

Figure 5-1 (Sheet 1 of 2)

MARKINGS

EXHAUST GAS TEMPERATURE

280°C to 692°C continuous operation

1000°C instantaneous limit for starting and acceleration

280°C minimum for flight

FUEL GRADE JP-4

OIL PRESSURE

5-60 PSI continuous operation

5 PSI minimum idle

60 Psi (maximum)

10 Psi fluctuation allowable if mean pressure is in normal operating range

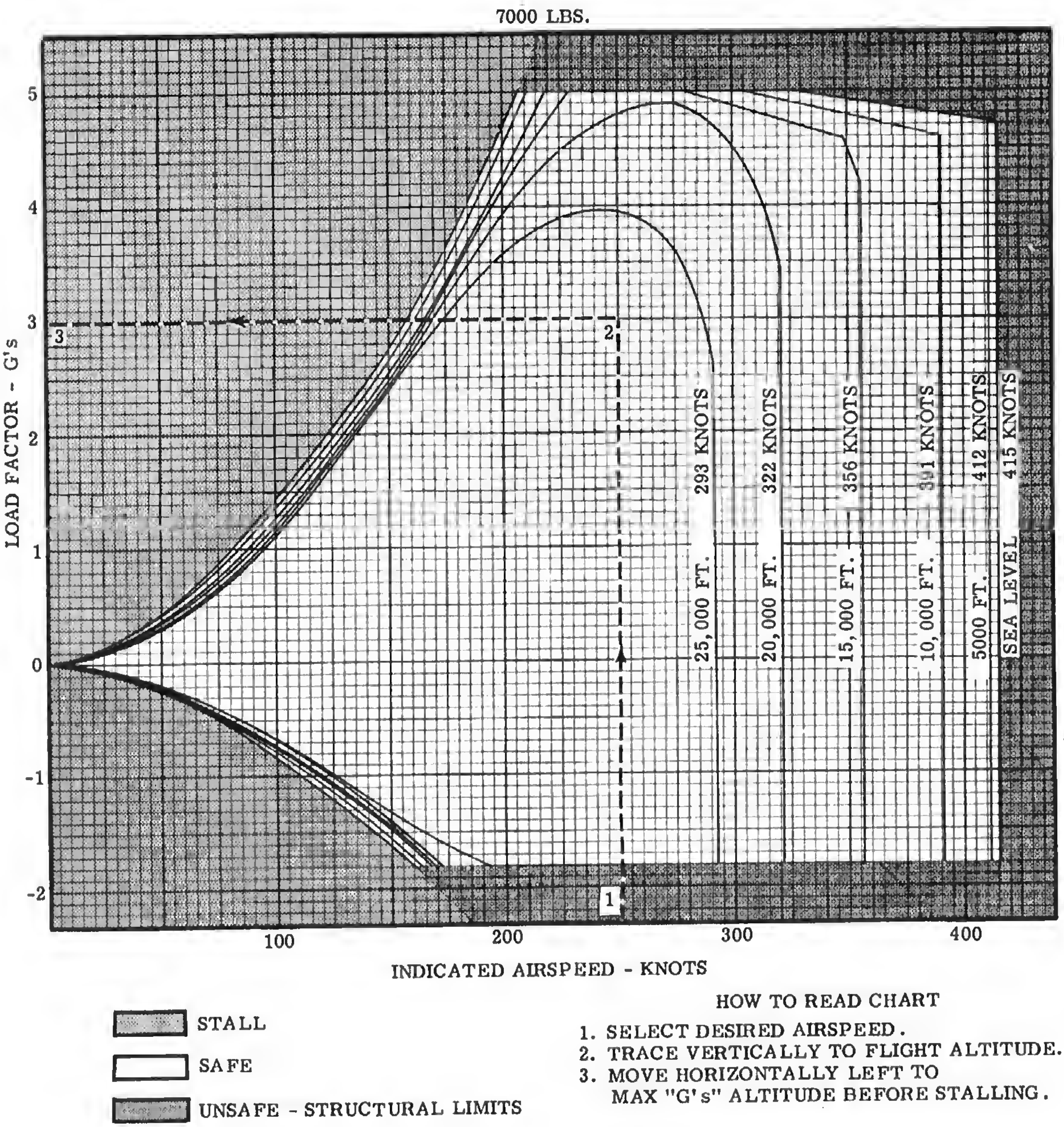
ACCELEROMETER

+5 G maximum at design gross weight

-1.8 G maximum at design gross weight

Figure 5-1 (Sheet 2 of 2)

OPERATING FLIGHT STRENGTH



HOW TO READ CHART

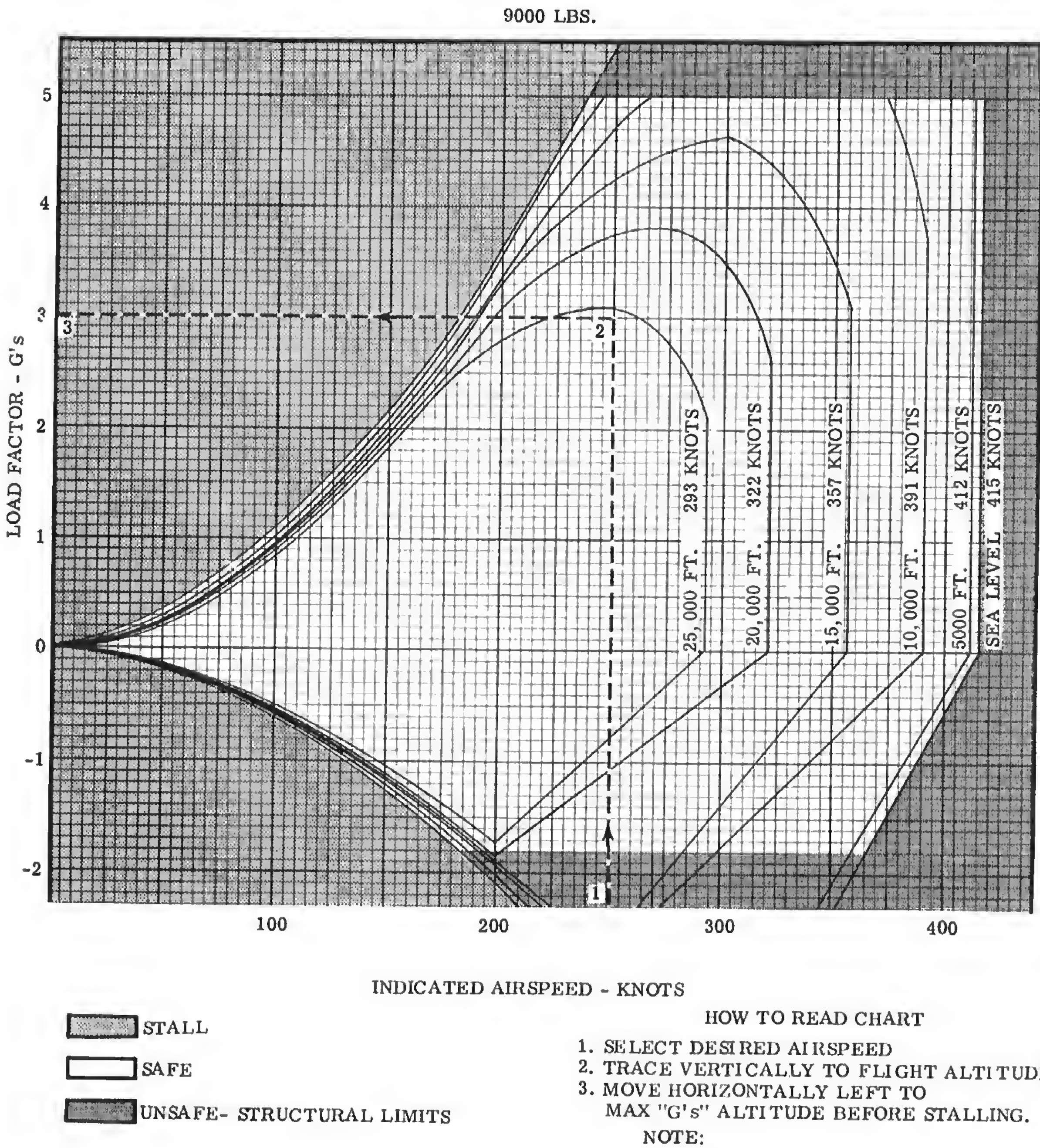
1. SELECT DESIRED AIRSPEED.
2. TRACE VERTICALLY TO FLIGHT ALTITUDE.
3. MOVE HORIZONTALLY LEFT TO MAX "G's" ALTITUDE BEFORE STALLING.

NOTE:

THE LIMITING STRUCTURAL AIRSPEED IS 415 KIAS OR .70 INDICATED MACH NO. WHICHEVER OCCURS FIRST.

Figure 5-2 (Sheet 1 of 3)

OPERATING FLIGHT STRENGTH



HOW TO READ CHART

1. SELECT DESIRED AIRSPEED
2. TRACE VERTICALLY TO FLIGHT ALTITUDE.
3. MOVE HORIZONTALLY LEFT TO MAX "G's" ALTITUDE BEFORE STALLING.

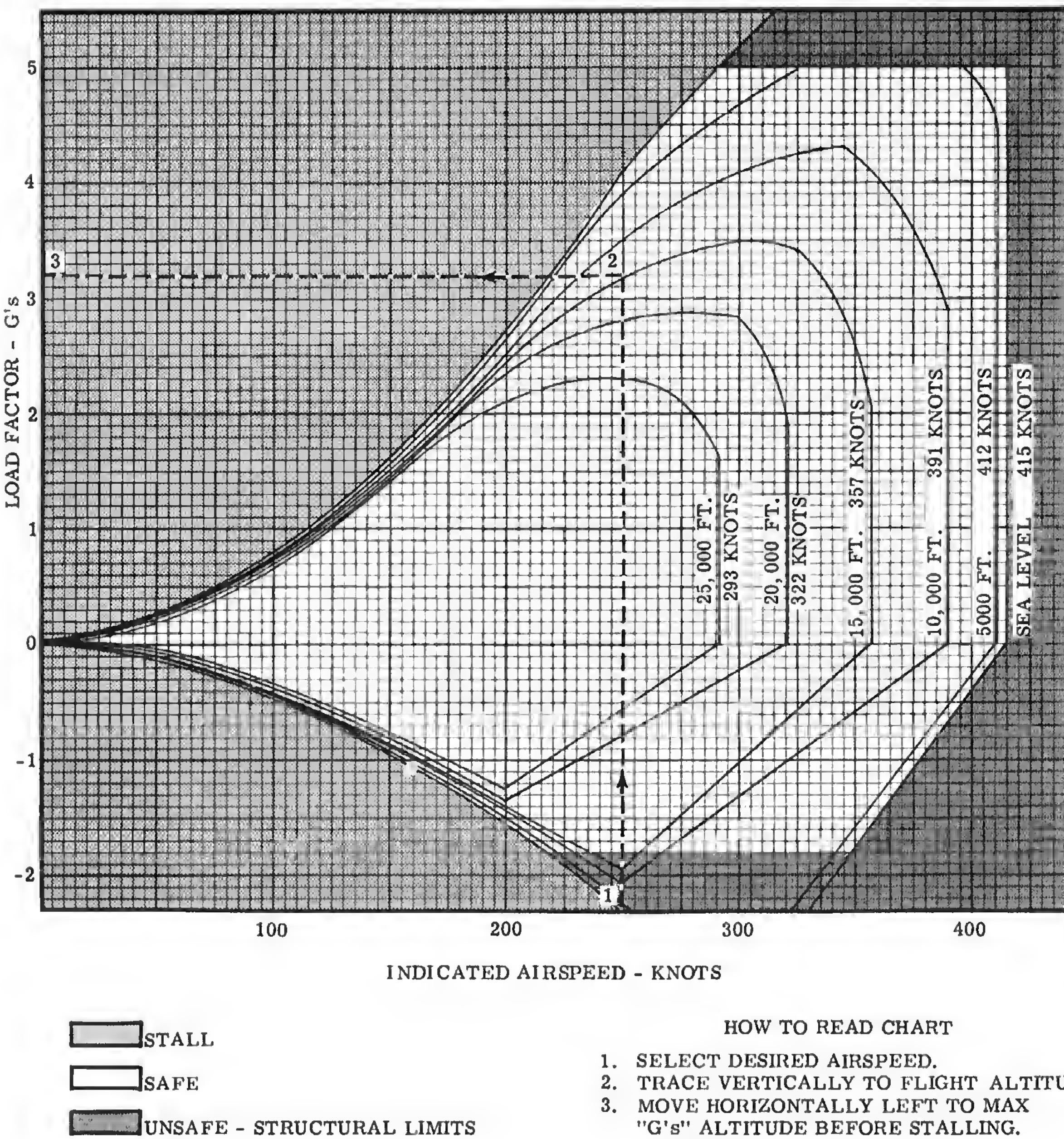
NOTE:

THE LIMITING STRUCTURAL AIRSPEED IS 415 KIAS OR .70 INDICATED MACH NO. WHICHEVER OCCURS FIRST.

Figure 5-2 (Sheet 2 of 3)

OPERATING FLIGHT STRENGTH

12000 LBS.



HOW TO READ CHART

1. SELECT DESIRED AIRSPEED.
2. TRACE VERTICALLY TO FLIGHT ALTITUDE.
3. MOVE HORIZONTALLY LEFT TO MAX "G's" ALTITUDE BEFORE STALLING.

NOTE:

THE LIMITING STRUCTURAL AIRSPEED IS 415 KIAS OR .70 INDICATED MACH NO. WHICHEVER OCCURS FIRST.

Figure 5-2 (Sheet 3 of 3)

Hard landing at high gross weights may result in structural damage to the aircraft. If a hard landing is experienced, this condition and the accelerometer indication should be entered in Form 781 in order that proper inspection for structural damage may be accomplished prior to subsequent flight.

EXTERNAL STORES LIMITATIONS.

Figure 5-5 lists all the authorized stores and their pylon location. The stores release and structural limits are shown in figure 5-4.

WARNING

USE OF OUTBOARD PYLONS LIMITED TO TIP TANKS EMPTY OPERATIONS ONLY

CONTACT SINKING SPEED

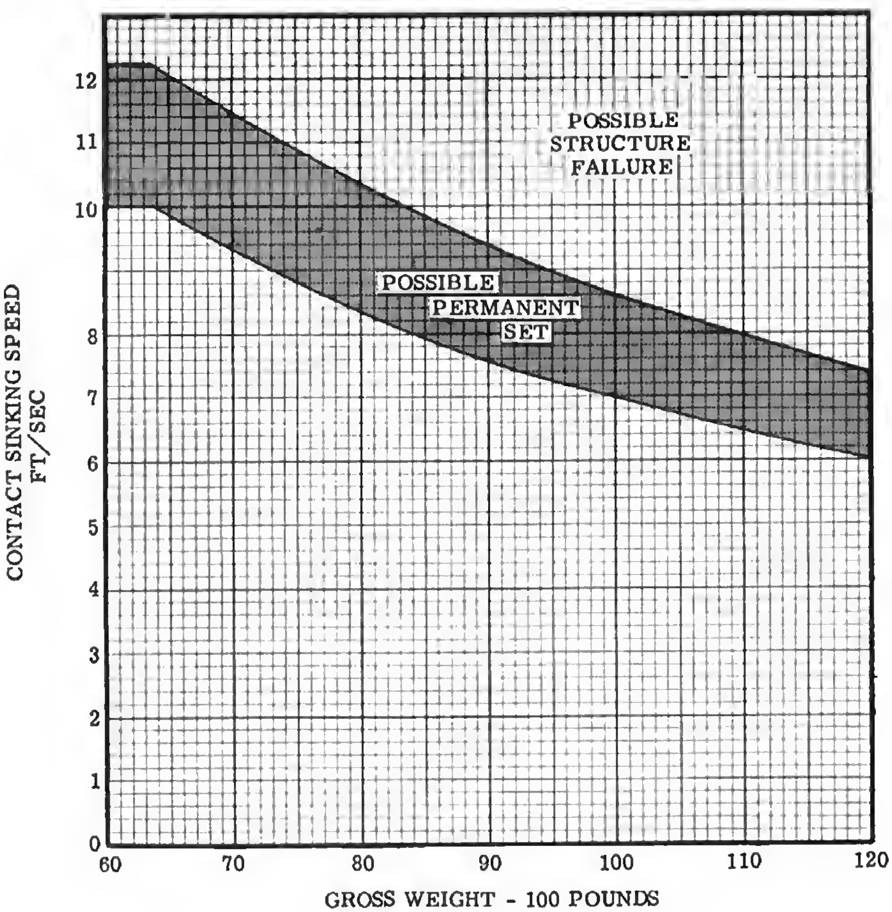


Figure 5-3

EXTERNAL STORES RELEASE LIMITS

STORE		LIMITATION KIAS—MAX.	RECM KIAS
DROP TANKS ✱	FULL EMPTY	300 250 (MIN. 200)	160 220
M117 M117A1 [2] ✱		350	
MK-81		350	
MK-82 [2] ✱		350	
MK-82 (SNAKEYE 1) ✱ [3] [5]		350	
LAU-3/A [10]	DISPENSE LOADED EMPTY	350 300 [11] 200	160 [12]
LAU-32A/A LAU-32B/A [10] LAU-59/A	DISPENSE LOADED EMPTY	350 300 [6] 200 [13]	160 [12]
SUU-11A/A [4]		350 (FIRING SPEED)	
SUU-25/A SUU-25A/A	DISPENSE [14] LOADED EMPTY	350 (MIN.140) 300 300	 200 200
BLU-1C/B BLU-23/B BLU-32/B BLU-27/B ✱		350 [8]	
CBU-24A/B [1] [2] ✱		350	
CBU-29A/B [1] [2] ✱		350	160
CBU-14/A CBU-14A/A [7]	DISPENSE LOADED EMPTY	350 200 200 [9]	 160 160
CBU-22/A CBU-22A/A [7]	DISPENSE LOADED EMPTY	[1] 200 200 [9]	 160 160
CBU-25/A CBU-25A/A [7]	DISPENSE LOADED EMPTY	350 200 200 [9]	 160 160
CBU-19/A	DISPENSE STRONGBACK	350 250 (MIN.150)	
SUU-20/A [4]	BOMBS: BDU-33/B MK-106 ROCKETS	350 350 350	
B-37K-1 [4]	BOMBS (BDU-33/B)	320	320
AN-M47A4		350	

Structural flight limitations are required for the stores specified with asterisk (✱).

Stores on the inboard pylons - Speeds up to 245 KIAS acceleration limited to 4.5 g's maximum except as limited by the stall boundary. At 400 KIAS acceleration limited to 4.0 g's maximum. (Limitation is not applicable if the outboard pylons are loaded.)

Stores on the inboard and inboard-intermediate pylons - Speeds up to 300 KIAS acceleration limited to 5.0 g's maximum except as limited by the stall boundary. At 370 KIAS acceleration limited to 4.25 g's maximum. (Limitation is not applicable if the outboard pylons are loaded.)

LEGEND:

[1] No flight qualification to date.

[2] Bomb guide required when carried on #2 pylon next to drop tank, BLU-1C/B or BLU-27/B.

[3] Not to be dropped during decelerating flight or dive angles greater than 30°.

[4] Jettison dispenser or pod in emergency only.

[5] Arming wire must extend a minimum of 36" to a maximum of 58" aft of the fin. Recommended length is 40".

[6] 200 KIAS maximum when next to drop tank, BLU-1C/B or BLU-27/B.

[7] Sway brace pads must be reversed for carriage.

[8] Do not drop above 300 KIAS when carried on #2 pylon next to drop tank, BLU-1C/B or BLU-27/B. If carried on both #1 and #2 pylons, drop #1 first.

[9] 160 KIAS when outboard of drop tank, BLU-1C/B or BLU-27/B.

[10] A maximum of two rocket launchers may be fired simultaneously if they are loaded symmetrically (one on the left wing and one on the right on equivalent stations). All other multiple rocket launcher firings are prohibited due to structural limitations. Rocket launchers may be fired one at a time from any station authorized for flight.

[11] 160 KIAS maximum when next to drop tank, BLU-1C/B or BLU-27/B.

[12] 120 KIAS when next to drop tank, BLU-1C/B or BLU-27/B.

[13] No flight qualification to date when next to drop tank, BLU-1C/B or BLU-27/B.

[14] Not to be dispensed during decelerating flight.

Figure 5-4

AUTHORIZED STORES LOCATION

STORE	TYPE	STORES LOCATION			
		L1,R1 (INBOARD)	L2,R2 (INBOARD INTERMEDIATE)	L3,R3 (OUTBOARD INTERMEDIATE)	L4,R4 (OUTBOARD)
AN-M47A4	WP BOMB	X	X	X	X
B-37K-1	PRACTICE BOMB CONTAINER RACK (WITH BDU-33)	X	X	X	X
BLU-1C/B.	FIRE BOMB	X	X		
BLU-23/B	FIRE BOMB	X	X	X	
BLU-27/B	FIRE BOMB	X	X		
BLU-32/B	FIRE BOMB	X	X	X	
CBU-14/A CBU-14A/A	DISPENSER & BOMBS	X	X	X	X
CBU-19/A	CANISTER CLUSTER		X	X	X
CBU-22/A CBU-22A/A	DISPENSER & BOMBS	X	X	X	X
CBU-24A/B CBU-24B/B	DISPENSER & BOMBS	X	X		
CBU-25/A CBU-25A/A	DISPENSER & BOMBS	X	X	X	X
CBU-29A/B CBU-29B/B	DISPENSER & BOMBS	X	X		
DROP TANK	FUEL-100 GAL	X	X		
LAU-3/A	ROCKET LAUNCHER	X	X	X	
LAU-32A/A LAU-32B/A LAU-59/A	ROCKET LAUNCHER	X	X	X	X
M-117 M-117A1	GP BOMB	X	X		
MK-81	GP BOMB	X	X	X	X
MK-82	GP BOMB	X	X.	X	
MK-82 (SNAKEYE 1)	GP BOMB	X	X	X	
SUU-11A/A	GUN POD	X	X	X	X
SUU-20/A	BOMB & ROCKET DISP	X	X	X	X
SUU-25/A SUU-25A/A	FLARE DISPENSER	X	X	X	X

Figure 5-5

SECTION VI

FLIGHT CHARACTERISTICS

TABLE OF CONTENTS

FLIGHT CHARACTERISTICS

This aircraft is designed for stability, safety, and good flight characteristics throughout its operational speed range. The flight controls are effective through all permissible maneuvers.

WARNING

Be sure to check fuel boost pump before doing any inverted flying or other maneuvers resulting in prolonged negative "G" forces (5 seconds or more). This is in addition to the fuel boost pump check required during ground operation prior to takeoff. If boost pump is inoperative, the engines will flameout during inverted flying or negative "G" force conditions, and an airstart will be prevented by an air lock. If boost pump is inoperative, land as soon as practical.

STALLS

Clean configuration stalls will be preceded by heavy buffeting occurring about four knots above the stalling speed. On accelerated stall entries, stall warning occurs approximately eight knots above stalling speeds. Power settings influence the stall warning airspeed but not the characteristics of the aircraft. When no artificial stall warning device is used, there is no stall warning in the power-on approach configuration. Lateral control throughout the stall maneuvers is good, and no uncontrollable rolling tendencies occur; however, holding the control stick full back will cause pitch oscillation of the aircraft. Elevator control is very good throughout the stall. A rapid forward movement on the control stick will cause the aircraft to pitch sharply which is followed by immediate recovery. Lowering the flaps decreases the stall speed markedly, but heavy buffeting still occurs well above the stalling speed. Aileron and elevator control remains good in a flap-down stall, and good recovery is easily obtained. Stalls with gear and flaps extended usually result in a roll-off to the left or right. This roll-out is easily controlled by prompt application of aileron control.

FLIGHT CONTROLS

PRIMARY CONTROLS

The primary flight controls (ailerons, elevators, and rudder) are very effective. The ailerons will remain effective throughout the speed range from limiting speed to stall speed. The elevators provide adequate pitch control to maneuver to the limiting load condition in the useful speed range. Caution should be exercised with regard to overcontrol during maneuvers because of sensitivity of the elevators. Directional control (rudder and ailerons combined) is ample to hold an on-course heading down to stall with only one engine operating.

CONTROL TRIM TABS

The control surface trim tabs will effectively reduce the control forces to zero for the useful flight range and operating extremes of the aircraft. Caution should be exercised in trimming the aircraft in high-dive speeds. See Section V, Operating Limitations. Out-of-trim stick forces caused by operation of the flaps, landing gear, and speed brake are controllable throughout the operating speed range. Refer to Section III for runaway trim procedures.

DIVING

The aircraft performs well in high speed dives and letdowns. A slight decrease in directional stability may occur at high speeds and high altitudes in dives with the speed brake extended, and will be noticeable to the pilot by the "hunting" motion of the nose.

The limit Mach number is .70 at low load factors, and it decreases as "G's" are pulled. Above this Mach number the aircraft tends to tuck under, the dive angle increases and considerable back pressure is required to prevent the dive angle from increasing. Because forward speed must decrease before recovery from this type of dive can be accomplished, a large loss in altitude results. The aircraft will also experience heavy buffeting at high speeds above the critical Mach number.

CAUTION

The critical Mach number can be exceeded when the aircraft is deliberately dived at very steep angles. Never allow the aircraft speed to exceed that indicated by the maximum allowable airspeed pointer which marks limit Mach number.

If critical speed is exceeded it can be detected by:

1. A rapid change in trim which requires considerable back pressure to keep the dive angle from increasing.
2. Buffeting of the aircraft and controls.

When steps one and two occur the recovery procedure is as follows:

1. MAINTAIN STICK FORCE TO KEEP AIRCRAFT FROM INCREASING DIVE ANGLE.
2. THROTTLES - IDLE.
3. SPEED BRAKE - OUT.

As altitude is lost and speed decreases below critical, a normal pullout may be executed.

Care should be taken not to dive at steep angles for prolonged periods without monitoring airspeed and executing pullout if critical speed is approached. For a more complete breakdown on the effect of a normal acceleration on critical speed, see figure 5-2.

WARNING

If you are lower than 10, 000 feet above the terrain before buffeting stops and pullout begins - EJECT.

SPEED BRAKE AND THRUST ATTENUATORS

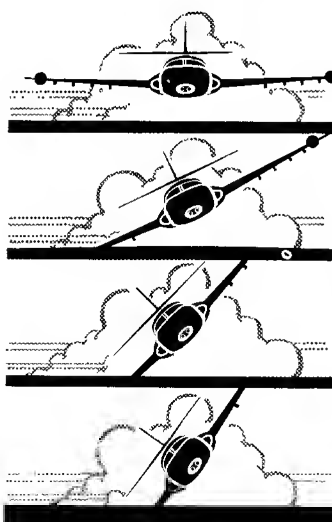
The speed brake is used to increase the aircraft drag for recovery from a high speed dive, to improve descent rate from altitude, and to increase the approach angle during landing. The speed brake is designed to give a minimum pitching moment change and only a small amount of nose UP trim is necessary on brake extension. Extension of the speed brake causes a noticeable buffet which decreases in intensity as airspeed is reduced.

The thrust attenuators are designed to reduce the effective thrust of the engine and serve the same purpose as the speed brake. Extension of the attenuators causes no noticeable pitch change. They enable the pilot to maintain a higher engine rpm on landing in order that faster accelerations will be available for go-around situations without flattening the approach angle. Both the speed brake and the attenuators may be safely extended at any speed within the useful range of operation. Since the speed brake and the thrust attenuators are intended to supplement each other, actuation is simultaneous by the same control switch.

STALL SPEED CHART

*** POWER OFF ... KIAS**

DATA BASIS: ESTIMATED
DATA AS OF: 1 APRIL 1967



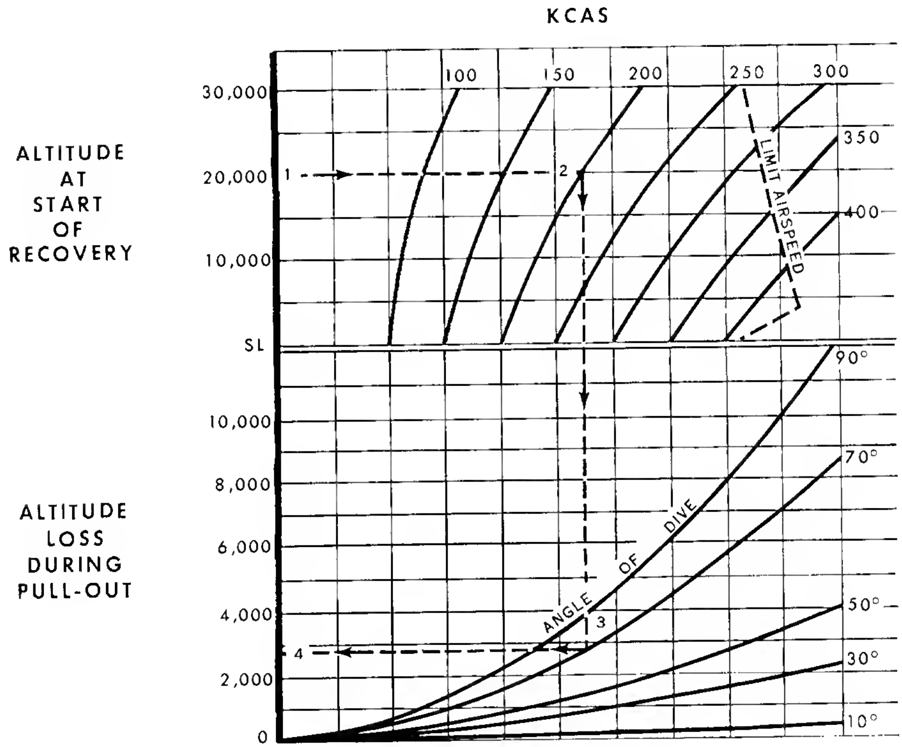
GROSS WEIGHT	6,000 LBS			9,000 LBS			12,000 LBS		
FLAP POSITION	UP	HALF	FULL	UP	HALF	FULL	UP	HALF	FULL
LEVEL FLIGHT	83	75	70	102	91	85	118	105	99
30° BANK	89	80	75	110	98	92	127	113	106
45° BANK	99	89	83	121	109	102	140	125	117
60° BANK	118	105	99	144	129	121	167	149	139

* FOR POWER-ON Stall Speeds, (Approx. 85%) Subtract 3 Knots.

Figure 6-1

ALTITUDE LOSS IN DIVE RECOVERY

CONSTANT 3G PULL-OUT



HOW TO USE CHARTS

Select appropriate chart, depending upon acceleration (3G, 4G, or 5G) to be held in pull-out; then—

1. Enter chart at altitude line nearest actual altitude at start of pull-out—Example 20,000 feet.
2. On scale along altitude line, select point nearest the CAS at which pull-out is started (200 KCAS).
3. Sight vertically down to point on curve at dive angle—70° directly below airspeed.
4. Sight back horizontally to scale at left to read altitude loss during pull-out.

Figure 6-2 ALTITUDE LOSS IN DIVE RECOVERY (Sheet 1 of 3)

ALTITUDE LOSS IN DIVE RECOVERY

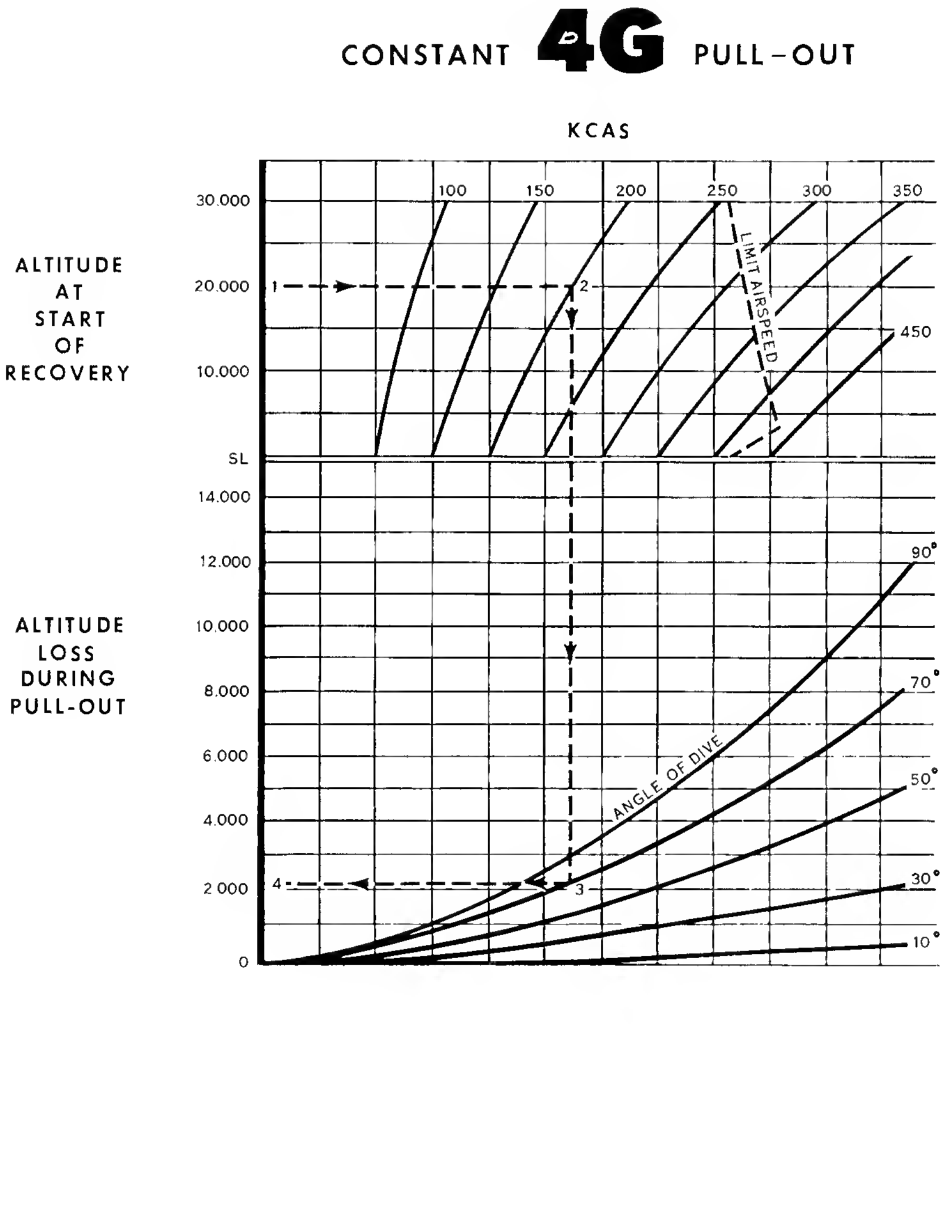


Figure 6-2 ALTITUDE LOSS IN DIVE RECOVERY (Sheet 2 of 3)

ALTITUDE LOSS IN DIVE RECOVERY

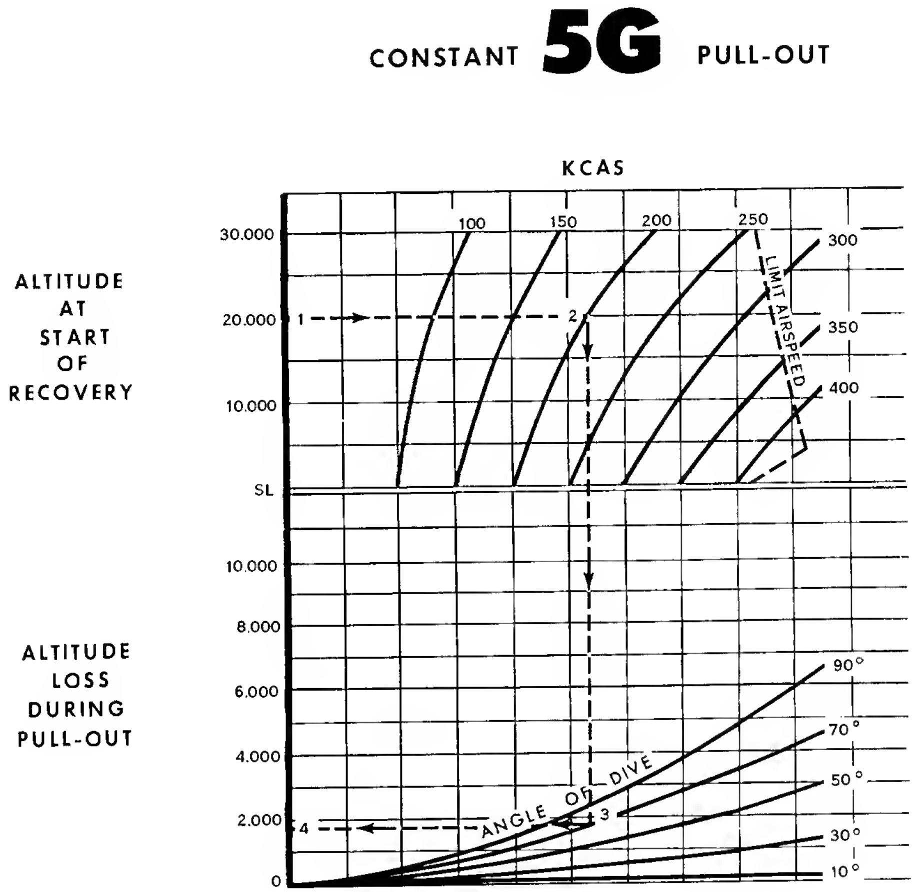


Figure 6-2 ALTITUDE LOSS IN DIVE RECOVERY (Sheet 3 of 3)

SECTION VII

ALL-WEATHER OPERATION

TABLE OF CONTENTS

Note

Except for some repetition necessary for emphasis, clarity, or continuity of thought, this section contains only those procedures that differ or are in addition to normal operating instructions covered in Section II.

INSTRUMENT FLIGHT PROCEDURES

INTRODUCTION

This aircraft has the same stability and flight handling charaeteristics during instrument flight eonditions as when flown under VFR conditions. Instrument flight through thunderstorms, ieing eonditions, or reliance upon radar control for instrument approaches in heavy or severe weather conditions is not recommended. Radio and navigation equipment in the aircraft will enable the pilot to make two types of instrument approaches; TACAN and radar. Special attention should be given to preflight fuel planning, since certain phases of instrument flying may require unexpected delays such as departure delays, holding, and the additional time required for approach proeedures. Particular attention should be given to the flight instrument, radio, and navigation equipment to insure that each is operating properly. Consult Appendix I for flight planning information and use particular care in planning an alternate destination. The following techniques are recommended from takeoff to touchdown under instrument or night flying conditions.

INSTRUMENT TAKEOFF

Complete the normal TAXI and BEFORE TAKEOFF check as prescribed in Section II and rotate the J-2 directional indicator so as to align with the top index. Adjust attitude indicator to superimpose the miniature aircraft and the horizon bar. Use nose wheel steering for directional control until rudder becomes effective at approximately 60 KIAS. While runway markings remain visible, they should be used as an aid in maintaining proper heading. At approximately 65 KIAS, increase pitch attitude to two bar widths nose high on the J-8. By maintaining this attitude, the aircraft will normally become airborne at approximately 90 KIAS.

When the altimeter and vertical velocity indicator indicate a positive climb, retract the landing gear at a minimum of 100 KIAS. Maintain a vertical velocity of 500 to 1000 feet per minute climb until tech order elimb speed has been attained.

CAUTION

Instrument takeoffs should not be made when a crosswind component of 10 knots or more exists.

INSTRUMENT CLIMB

Refer to Appendix I for the best climb data. Turns should not be attempted below 500 feet above the terrain and for ease and precision of flight, limit all turns to 30° bank angle.

INSTRUMENT CRUISING FLIGHT

Instrument eruise procedures do not differ from normal flight procedures. For ease and precision of flight, the angle of bank should be limited to 30° during all turns.

Note

The aircraft has a tendency to bounce and yaw when flying in light to moderate turbulence.

RADIO AND NAVIGATION EQUIPMENT

Refer to Section I for radio and navigation equipment installed in the aircraft.

HOLDING

Recommended holding pattern airspeed is 160 KIAS above 14, 000 feet and 140 KIAS at or below 14, 000 feet. To descend when holding at high altitude reduce power to 65% rpm minimum and maintain holding pattern airspeed, using speed brake as desired. sired.

DESCENT AND PENETRATION

Descents to initial penetration altitude, before reaching the destination fix, may be made at the airspeeds and power settings given in Part VI of Appendix I. Descents from initial penetration altitude or lower should be made using normal penetration procedures.

TACAN JET PENETRATION

INITIAL ALTITUDE	20,000 FT.
FUEL (LBS.) USED FINAL APPROACH	85

NOTE:
THE ABOVE FIGURES ARE FOR A TYPICAL PENETRATION.

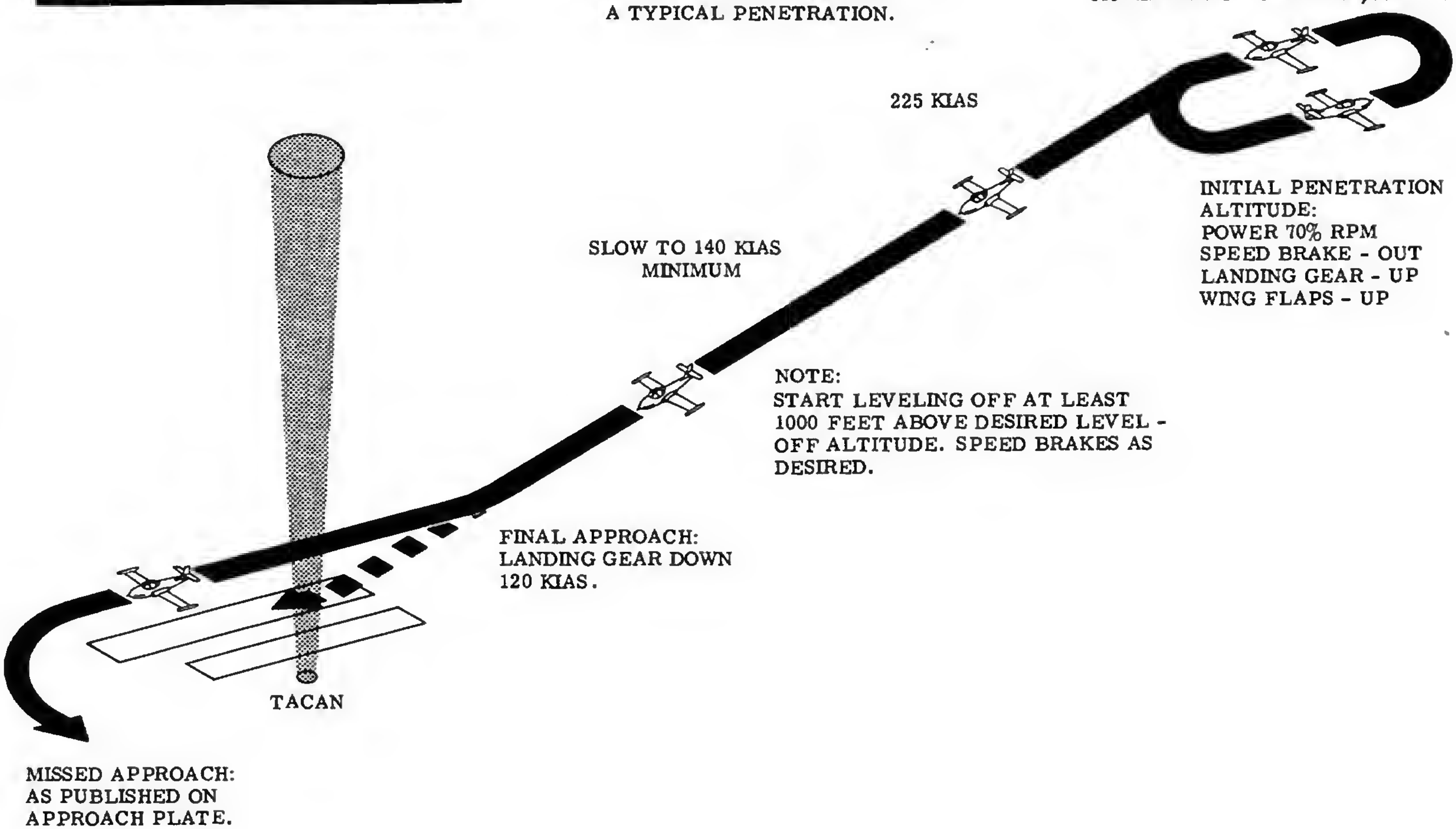


Figure 7-1

Note

Various power settings can be used and descents can be made up to the maximum allowable airspeed for the aircraft. However, 180 KIAS produces the most satisfactory flight characteristics in turbulence.

For a normal penetration, starting at initial penetration altitude, reduce the power to 70% and simultaneously lower the pitch attitude approximately 10°, place the horizon bar halfway between the 60° and 90° bank indices on the J-8 attitude indicator to establish 225 KIAS and extend the speed brakes.

Note

- The cockpit and windshield should be kept as warm as possible before and during descents to eliminate fogging conditions on the canopy during rapid descents.
- Pilot should be aware that aerobatics will induce gross precession errors in the attitude indicator.

Figure 7-1 shows a typical TACAN jet penetration and instrument approach; however, the published procedures for jet penetration may vary at USAF, Navy, and civil installations. Consult the Flight Information Publication (Terminal) for current approach to your destination during the planning phase of your flight.

Start level off from the penetration descent at 1000 feet above the desired altitude by decreasing the pitch attitude on the attitude indicator by one-half. When reaching the normal lead point (approximately 10% of the vertical velocity), slowly raise the nose of the aircraft to level off at the desired altitude. The speed brake is normally retracted when initiating the level off, however, it may be left extended to obtain the desired airspeed and configuration at the final approach fix. This will depend upon when the descent was begun, the type of approach to be made, and the distance/time from the station to the field. After level off, maintain a minimum of 65% rpm and a minimum of 140 KIAS to the station. Lower the landing gear and maintain 120 KIAS prior to or over the station depending upon the type of approach.

INSTRUMENT APPROACHES

Aircraft performance differences have a direct effect on the airspace and visibility needed to perform certain maneuvers, such as circle to land, turning missed approaches, final alignment correction to land, and descent. Based on aircraft weight and final approach airspeed criteria, this aircraft will use Category B approach minimums.

Figure 7-1 shows a typical TACAN approach, and Figure 7-2 shows a standard rectangular version of the basic radar pattern. With heavy fuel loads or turbulent conditions, it may be necessary to use higher than normal power to maintain the desired indicated airspeeds. Normally, 140 KIAS is used for all maneuvering prior to the actual approach. For the approach, lower the landing gear and maintain 120 KIAS. For a straight-in approach, extend the speed brake and wing flaps when the field is in sight and maintain a minimum of 100 KIAS. When a circling approach is required, extend the speed brake and wing flaps on base leg of final as desired and maintain a minimum of 110 KIAS during the base leg and a minimum of 100 KIAS on final approach. To descend with a clean aircraft configuration, extend the speed brake and maintain a minimum of 65% rpm. To descend in the landing configuration, vary the power to maintain the recommended approach airspeed. Use of speed brake is optional.

MISSED APPROACH

The recommended procedure for executing a missed approach is to apply power to 100% rpm, retracting speed brake as power is applied, and establish an instrument takeoff attitude. Gear and flaps should then be retracted. When the climb airspeed reaches a minimum of 140 KIAS, reduce power to approximately 85% until reaching missed approach altitude. When the desired altitude is reached, reduce power to maintain a minimum of 140 KIAS or a minimum power setting of 65% rpm.

Note

If speed brake is used on final approach, opening and closing of the thrust attenuators will occur when power is adjusted near the 55% rpm power setting.

SINGLE ENGINE APPROACH

Refer to Section II, Figure 7-1 and Figure 7-2 for single engine landing procedures. If a single engine penetration is required, proceed as in a normal penetration except use 75% rpm on the operating engine and retract the speed brake when initiating the level off at 1000 feet above the desired altitude. After level off, maintain a minimum of 120 KIAS. For a straight-in approach, attain landing configuration (landing gear down and half flaps) on final approach and maintain 110 KIAS. For a circling approach attain landing configuration (landing gear down and half flaps) on base leg or final and maintain a minimum of 110 KIAS. The speed brakes should not be extended until landing is assured.

RADAR LETDOWNS

Radar letdowns of various types can be made in this aircraft. By proper radar control techniques for the letdown and turn onto final approach, maximum economy of fuel and time can be realized.


RADAR
PATTERN
DOWN WIND LEG
AIRSPEED—140 KIAS MINIMUM
THROTTLES—APPROXIMATELY 65% RPM
BASE LEG
AIRSPEED 120 KIAS
THROTTLES—APPROXIMATELY 73% RPM
LANDING GEAR—DOWN
FINAL APPROCH
AIRSPEED—110 KIAS
THROTTLES— APPROXIMATELY 65% RPM
WING FLAPS—FULL DOWN
GLIDE SLOPE
AIRSPEED — 100 KIAS
THROTTLES—APPROXIMATELY
65% RPM
SPEED BRAKE—OUT
MISSED APPROACH
THROTTLES—MAXIMUM
SPEED BRAKE—IN
AIRSPEED—140 KIAS
LANDING GEAR—UP
WING FLAPS—UP
TOUCHDOWN
AIRSPEED—80 KIAS
USAF
ENTRY
AIRSPEED—140 KIAS MINIMUM
CLEAN CONFIGURATION
NOTE
IF FUEL IS CRITICALLY LOW, REQUEST A MINIMUM
FUEL RADAR PATTERN AND DELAY LOWERING GEAR
UNTIL ON FINAL APPROACH.

Figure 7-2

ICE AND RAIN

ICE

Icing of the air intake area is an ever-present possibility during operation in weather with temperature near the freezing point. An engine ice warning light, located on the instrument panel, will illuminate when ice forms over the ice detect probe located in the left engine air inlet duct. This may be the only noticeable indication of ice formations until ice ingestion occurs.

WARNING

> There is no deicing equipment installed on this aircraft. Ice on the air intake, when ingested, may cause the engines to flameout. Cruising in icing conditions should, therefore be avoided.

Cruising in areas of known or suspected icing conditions is not recommended. Ice will normally adhere to the windshield, wing leading edges, empennage, and air inlet areas. Altitude should be changed immediately upon the first sign of ice accumulation. Ice accumulation on the empennage will cause the elevators to freeze to the horizontal stabilizer. Ice accumulation on the air intake area may cause both engines to flameout by ice ingestion. The windshield defroster is not effective in preventing the formation of ice or removing ice from the windshield. The resultant drag associated with aircraft icing acts to reduce the airspeed and to increase the power requirements, with a consequent reduction of range.

WARNING

- When flying in icing conditions be constantly alert for the elevators freezing to the horizontal stabilizer. Considerable force is required to break the elevators loose. Leave the area of icing as soon as possible.
- Ice accumulations will greatly increase the stalling speed; therefore, extreme caution must be exercised when landing under such conditions.

Note

> Ice breaking loose from the nose area will strike the tail; the impact will be alarming but normally will cause no damage.

If icing conditions are encountered at freezing atmospheric temperatures, change altitude rapidly by climbing or descending.

RAIN

Prior to entering an area of precipitation, turn pitot heat on.

TURBULENCE AND THUNDERSTORMS

CAUTION

> Flight through thunderstorms or other areas of extreme turbulence should be avoided. Maximum use of weather forecast facilities and ground radar to aid in avoiding thunderstorms and turbulence are essential.

Should flight through an area of thunderstorm activity become necessary, the following recommended procedures should be followed:

1. Preparation - Turn on pitot heat, tighten seat belt, lock shoulder harness, and stow loose items. At night, use white lighting to minimize blinding effect of lightning.

Note

> Make every effort to avoid looking up from the instrument panel at lightning flashes. The blinding effect of lightning can be reduced by lowering the seat.

2. Airspeed - A penetration airspeed of 180 KIAS should be established. Trim the aircraft for level 1
flight at this speed. Severe turbulence may cause large and rapid variations in indicated airspeed. Do not chase the airspeed.
3. Attitude - The key to proper flight technique through turbulence is attitude. Both pitch and bank should be controlled by reference to the attitude indicator. Do not change trim after the proper attitude has been established. Extreme gusts will cause large attitude changes. Use smooth and moderate aileron and elevator control inputs to re-establish the desired attitude. To avoid over-stressing the aircraft, do not make large or abrupt attitude changes.
4. Thrust - Establish and maintain the thrust setting consistent with the desired penetration and altitude.
5. Altitude- Severe vertical gusts may cause appreciable altitude deviations. Allow altitude to vary. Sacrifice altitude to maintain desired attitude. Do not chase the airspeed.

IN THE STORM

When in the storm, maintain power setting and level flight attitude. Do not attempt to compensate for changes in indicated airspeed or altitude. Concentrate on maintaining a constant attitude and heading. Do not make any turns unless absolutely necessary.

NIGHT FLYING

During normal VFR flight, unfiltered lights should be used sparingly. Reflections in the canopy may be reduced by lowering the intensity of all cockpit lights.

Note

- During night weather, reflections from the anti-collision lights on clouds or precipitation may create a distraction to the pilot and induce spatial disorientation. If so, the anti-collision beacons should be turned off until clear of the area of reduced visibility.

- When making VFR takeoffs in areas of limited horizon references, referral to the flight instruments is recommended to avoid flying back into the ground after takeoff.

CAUTION

Damage to the landing light extension motors may be caused by extending the lights above 135 KIAS.

COLD WEATHER PROCEDURES

The success of low temperature operation depends primarily upon the preparations made during the post-flight inspection, in anticipation of the requirements for operation on the following day. In order to expedite preflight inspection and insure satisfactory operation for the next flight, normal operating procedures outlined in Section II should be adhered to with the following additions and exceptions.

BEFORE ENTERING AIRCRAFT

Remove all protective covers and dust plugs and check that the entire aircraft is free from frost, snow, and ice. Depending upon the weight of snow and ice accumulated, takeoff distances and climb out performance can be seriously affected. The roughness and distribution of the ice and snow could vary stall speeds and characteristics to an extremely dangerous degree. In view of the unpredictable and unsafe effects of such a practice, the ice and snow must be removed before flight is attempted. Brush off all light snow and frost. Remove ice by a direct flow of air from a portable ground heater.

WARNING

- Care should be taken to insure that water from melted ice is sponged so that it will not drain to some critical area and refreeze.

- Insure that water is drained from the fuel tanks before cold weather operations.

If during operation of the canopy, it is found that the raising or lowering puts undue strain on the canopy motor or hinges, preheat should be applied to insure normal operation. Be sure that the fuel tank vents, fuel filter, and drain cocks are free from ice and drain condensate. Check that the static air, pitot tube, and transducer vane are free of ice. If ice within the engine is suspected, check the engine for freedom of rotation. If engines are not free, external heat must be applied to forward engine section to melt the ice. Check shock struts and actuating cylinders for dirt and ice.

ON ENTERING THE AIRCRAFT

Check flight controls for proper operation and insure that canopy can be closed and locked. To conserve the battery, use external power to operate all electrical and radio equipment.

STARTING ENGINES

Start the engines using the normal starting procedure outlined in Section II. Oil pressure may be high after starting cold engines. This is not dangerous unless the pressure remains high. Takeoff should not be made until oil pressure drops to normal.

Note

If normal starting rpm (6 - 8%) cannot be obtained, shutdown the engine and connect an adequate power source.

WARMUP AND GROUND CHECK

Turn on cabin heat and windshield defrosting system, as required, immediately after starting engines. Check the speed brake, thrust attenuators, and trim tabs for proper operation. Check the wing flaps and flap indicator for operation. If questionable readings result, recycle the flaps three to four times as a check on the indicator action.

WARNING

Make sure all instruments have warmed up sufficiently to insure normal operation. Electric gyro instruments require approximately two minutes for warmup.

CAUTION

Because of low ambient temperatures, the thrust at all engine speeds is noticeably greater than normal. This should be remembered during all ground operations, and firmly anchored wheel chocks used for all engine runups.

TAXIING INSTRUCTIONS

Avoid taxiing in deep snow. Use only essential electrical equipment to preserve battery life while taxiing at low engine speeds. Increase space between aircraft while taxiing to provide safe stopping distance and to prevent icing of aircraft surfaces by melted snow and ice in the jet blast of preceding aircraft. Taxi speed should be reduced when taxiing on slippery surfaces to avoid skidding.

WARNING

Make sure all instruments have been sufficiently warmed up to insure normal operation. Check for sluggish instruments during taxiing.

TAKEOFF

Make final instrument check during the first part of the takeoff as the brakes will not hold the aircraft on snow covered or icy runways at full throttle. Advance throttles smoothly or swerving may result.

Note

Nose wheel steering is essential for takeoff from icy runway.

AFTER TAKEOFF

If takeoff from a snow or slush covered field is made, the brakes should be operated several times to expel wet snow or slush, and the landing gear and wing flaps operated through several cycles to prevent their freezing in the retracted position.

CAUTION

Do not exceed the landing gear and wing flaps down limit airspeed during this operation.

DESCENT

Rapid descents generally cause a fogging condition to exist inside the canopy and windshield. Therefore, it is necessary that the pilot preheat the canopy and windshield approximately 10 minutes before a descent is made. A slight discomfort to the pilot may be encountered but preheating aids in preventing canopy and windshield fog.

WARNING

The collection of snow, frost, and ice on the aircraft constitutes one of the major flight hazards in low temperature operation and will result in the loss of lift and in treacherous stalling characteristics.

APPROACH TO PATTERN

Make normal pattern and landing as outlined in Section II.

BEFORE LEAVING THE AIRCRAFT

Release brakes after wheels are chocked and leave canopy partly open to allow circulation within the cockpit to prevent canopy cracking from contraction and to reduce windshield and canopy frosting. Whenever possible, leave the aircraft parked with full fuel tanks. Every effort should be made during servicing to prevent moisture from entering the fuel system. Check that protective covers and dust plugs are installed, and that the battery is removed when aircraft is outside in temperatures below -29°C (-20°F), for more than four hours.

DESERT AND HOT WEATHER PROCEDURES

Hot weather and desert operation is identical with normal operation with few exceptions. Takeoff and landing rolls are longer due to lower air density. Added precautions should be taken to protect the rubber or plastic parts of the aircraft from damage by excessive heat.

BEFORE ENTERING THE AIRCRAFT

Inspect intake ducts for sand or other foreign objects. If excessive sand is found, do not start the engine. Inspect tires for blister, deterioration, and proper inflation. Check for hydraulic system leaks as heat and moisture may cause packing and valves to swell.

TAXIING INSTRUCTIONS

Taxi with minimum power to minimize the blowing of dust and sand into other aircraft. Keep adequate distance from any other aircraft taxiing ahead of you, and use brakes as little as possible to prevent overheating.

TAKEOFF

During takeoff, the aircraft will accelerate slowly and ground run will be longer because the air is less dense in hot weather. Ground speed will be increased for the same IAS.

AFTER TAKEOFF

Follow the normal flight procedures, being particularly careful to maintain throttle settings that will keep the exhaust gas temperature within the prescribed engine limitations.

DESCENT

Turn on defroster prior to descent since warm humid air is likely to cause canopy frosting in hot weather descents.

APPENDIX

PERFORMANCE DATA

The appendix is divided into nine parts as follows: Part I, Introduction; Part II, Takeoff; Part III, Climb; Part IV, Range; Part V, Endurance; Part VI, Combat Allowance; Part VII, Descent; Part VIII, Landing; and Part IX, Mission Planning. These Parts are presented in proper sequence for preflight planning. Discussions and sample problems are given in each part.

TABLE OF CONTENTS

INTRODUCTION

TABLE OF CONTENTS

INTRODUCTION

The flight performance charts provide the pilot with sufficient data for preflight and in-flight planning. All charts are based on ICAO (International Civil Aviation Organization) Standard Day conditions. When necessary, temperature corrections for non-standard atmosphere have been included on the charts. Charts for climb, cruise, endurance and descent performance are presented in drag index form.

CALIBRATED AIRSPEED

Calibrated airspeed (CAS) is indicated airspeed corrected for both error in the airspeed sensing system and in the airspeed indicator. The error in the indicator is usually very small and not available to the pilot and is, therefore, normally ignored for routine flying. Calibrated airspeed as used in this manual shall then be indicated airspeed corrected for airspeed sensing system (installation) error only by the values given in figure A1-1.

AIRSPEED CORRECTION

Charts are provided to obtain calibrated airspeed (CAS), equivalent airspeed (EAS), and true airspeed (TAS). Ground speed (GS) is TAS corrected for wind.

INDICATED AIRSPEED

Indicated airspeed (IAS) is read directly from the airspeed indicator.

ALTITUDE CORRECTION

The error in indicated altitude is negligible and shall be indicated altitude corrected for installation error only by the value given in figure A1-2.

EQUIVALENT AIRSPEED

Equivalent airspeed (EAS) is calibrated airspeed corrected for the effects of compressibility. Although this correction is negligible at low speed and low altitude, it may be as much as seven or eight knots at higher speeds and altitudes. The corrections shown in the Compressibility Correction Charts (figure A1-3) are subtracted from the calibrated airspeed to obtain equivalent airspeed.

TRUE AIRSPEED

True airspeed (TAS) is equivalent airspeed corrected for atmosphere density. The Type CPU-26P dead-reckoning computer or figure A1-5 may be used for this correction.

SPEED CONVERSION CHART

The Speed Conversion Chart (figure A1-4) is used to convert calibrated airspeed (CAS) directly to true airspeed (TAS). The compressibility effect has been included in this chart.

DENSITY ALTITUDE CHART

The Density Altitude Chart figure A1-5 is used to determine the density altitude and the value of $\sqrt{\frac{1}{\sigma}}$ for any pressure altitude and ambient temperature. To use the chart, enter with ambient temperature (corrected for compressibility) and read up to the appropriate pressure altitude line. Read to the left to find density altitude and to the right to find the value of $\sqrt{\frac{1}{\sigma}}$

ICAO STANDARE ATMOSPHERE TABLE

The ICAO Standard Atmosphere Table figure A1-6 gives the standard atmospheric values, as defined by ICAO, in increments of 1000 feet from sea level to 35, 000 feet. The values of $\sqrt{\frac{1}{\sigma}}$ (Smoe), Density Ratio (σ), temperatures, speed of sound, barometric pressure in inches Hg, and pressure ratio (δ), are given for each altitude increment.

STORE DRAG INDEXES AND GROSS WEIGHTS

The Store Drag Index and Gross Weight chart, figure A1-7, gives the drag index and approximate weight of each store that can be carried on the external racks. These drag indexes, when added to the drag index of the aircraft in the clean configuration, represent the total drag index of the aircraft and are used to compute climb, and cruise performance. It will be noted on the chart that certain stores will have a different drag index when installed on different wing stations. The rocket launchers also have different drag indexes when loaded than when empty. The drag index of 0 for the clean configuration is based on nose gun installed, all external racks installed, gear and wing flaps up.

The drag index of a loaded aircraft is computed by adding the total drag counts for all stores to the basic drag index of 0. The following sample of loading configuration illustrates a typical drag count for a mission requiring mixed stores, and the gross weight that would be used for initial preplanning of the fuel load.

Total drag count for each wing (symmetrical loading) is 71, or a total for both wings of 142. Added to the drag index for clean configuration the drag index for the loaded aircraft is 142. Gross weight of the loaded stores, is 2245. Assuming that all stores are expended, the drag index for return from the target area is figured on the rocket launchers and fuel tanks. Due to the increased drag of the rocket launchers after the rockets have been fired, the drag index for the return comes to (26 + 49 = 75 x 2 = 150 + 0 = 150).

STATION	STORE	WEIGHT	DRAG INDEX
L1-R1	100 Gallon Fuel Tank	735	26
L2-R2	M117 G. P. Bomb	823	20
L3-R3	LAU-3/A Rocket Pod	(Loaded) 427	19
		(Empty) 71	49
L4-R4	MK-81 L. D. Bomb	260	6

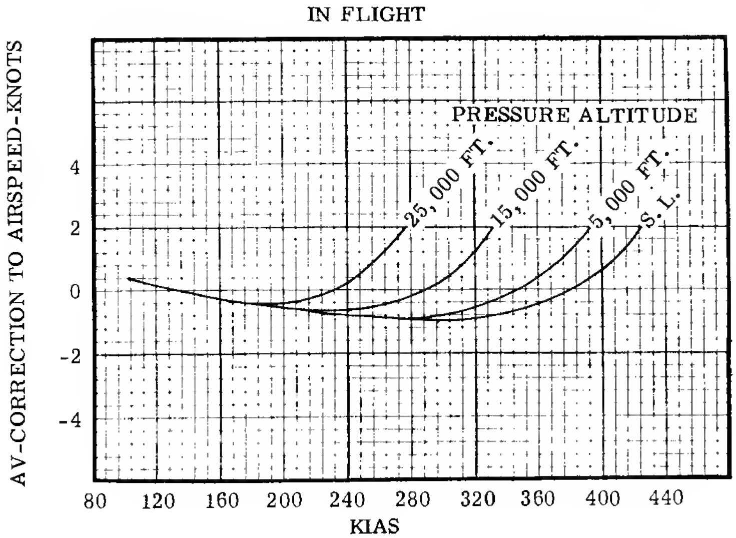
SYMBOLS AND DEFINITIONS

SYMBOLS	DEFINITIONS
CAS	Calibrated airspeed, indicated airspeed corrected for position error: CAS = IAS + correction.
Δ	Delta - "Change in" (e. g., temperature).
δ	Delta - Ratio of ambient air pressure to standard sea level air pressure.
EAS	Equivalent airspeed, calibrated airspeed corrected for compressibility: EAS = CAS - correction.
GS	Ground speed, true airspeed corrected for the wind component velocity: GS = TAS + V_W.
h_d	Density altitude, that value obtained from the density altitude chart, figure A1-5, at which air density at the observed pressure altitude equals air density as defined by the International Civil Aviation Organization (ICAO).
Hg	Mercury

SYMBOLS	DEFINITIONS
IAS	Indicated airspeed, airspeed indicator uncorrected. Where this symbol (IAS) is used on the performance charts, mechanical error in the instrument is assumed to be zero.
Kn or Kts	Knots, Nautical miles per hour.
OAT	Outside air temperature.
ρ_0	Density of atmosphere at sea level in slugs/cubic feet.
p	Atmospheric pressure at any altitude (inches Hg).
p_0	Standard sea level pressure (29. 92 inches Hg).
ρ	Rho-Density of atmosphere at any altitude in slugs/cubic feet.

SYMBOLS	DEFINITIONS
σ	Sigma-Ratio of density at altitude to density at sea level ρ/ρ_0
$\sqrt{\frac{1}{\sigma}}$	Smoe - Correction factor for air density applied to TAS.
TAS	True airspeed, equivalent airspeed corrected for atmospheric density: TAS = EAS x $\sqrt{\frac{1}{\sigma}}$
V	True Airspeed
V_W	Wind velocity component. Headwinds considered negative, tail winds considered positive.

AIRSPEED POSITION CORRECTION



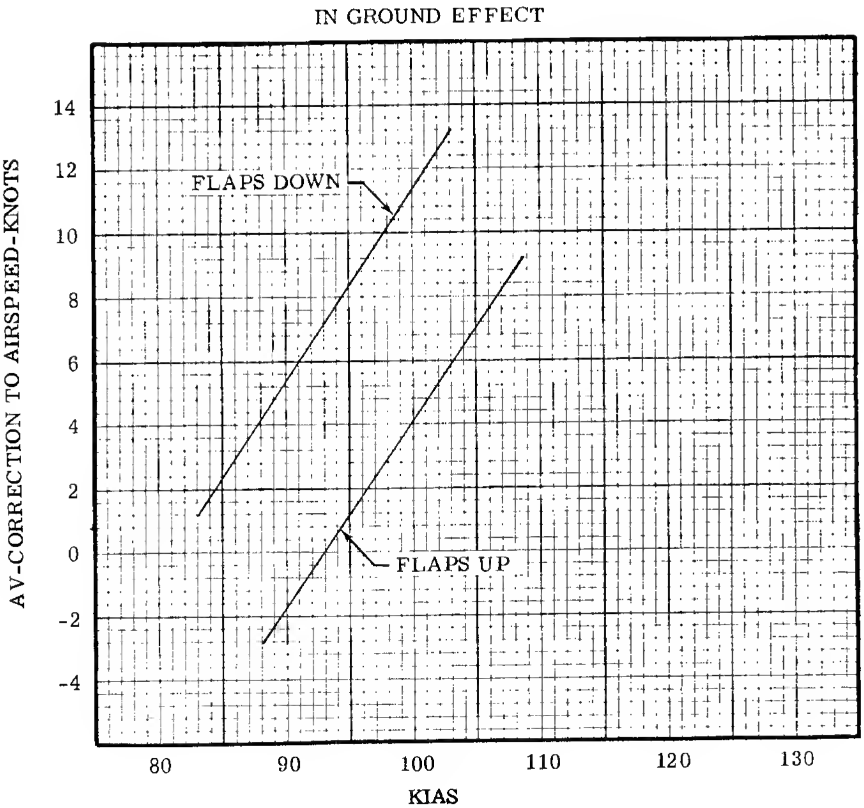


Figure A1-1

ALTIMETER POSITION CORRECTION

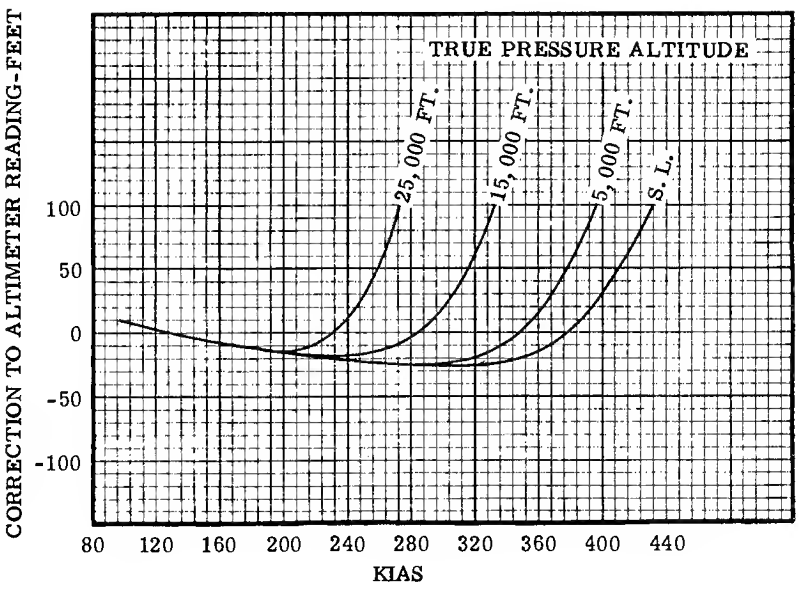


Figure A1-2

COMPRESSIBILITY CORRECTION CHART

SUBTRACT COMPRESSIBILITY CORRECTION FROM KCAS TO OBTAIN KEAS.

EXAMPLE: During flight at 20,000 feet and 200 KCAS, Compressibility Correction is 3 knots. Subtract 3 from 200 to obtain 197 KEAS.

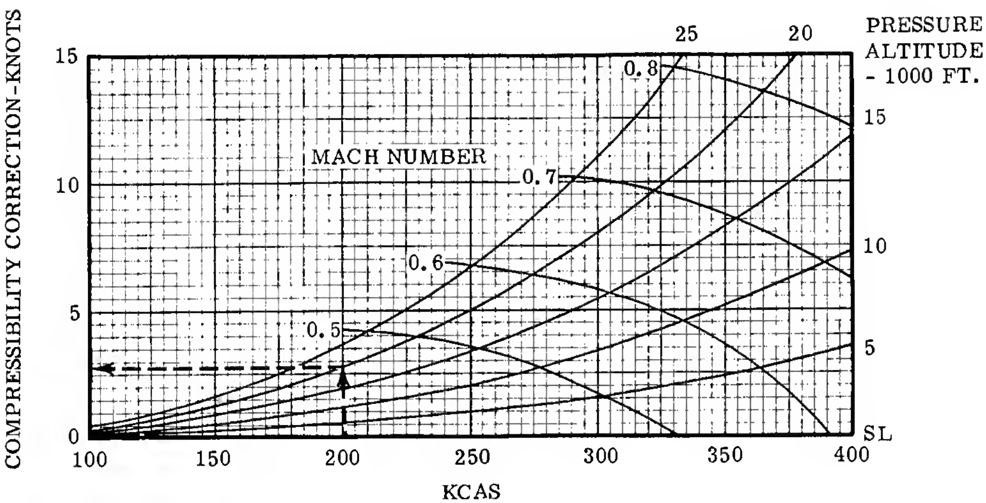
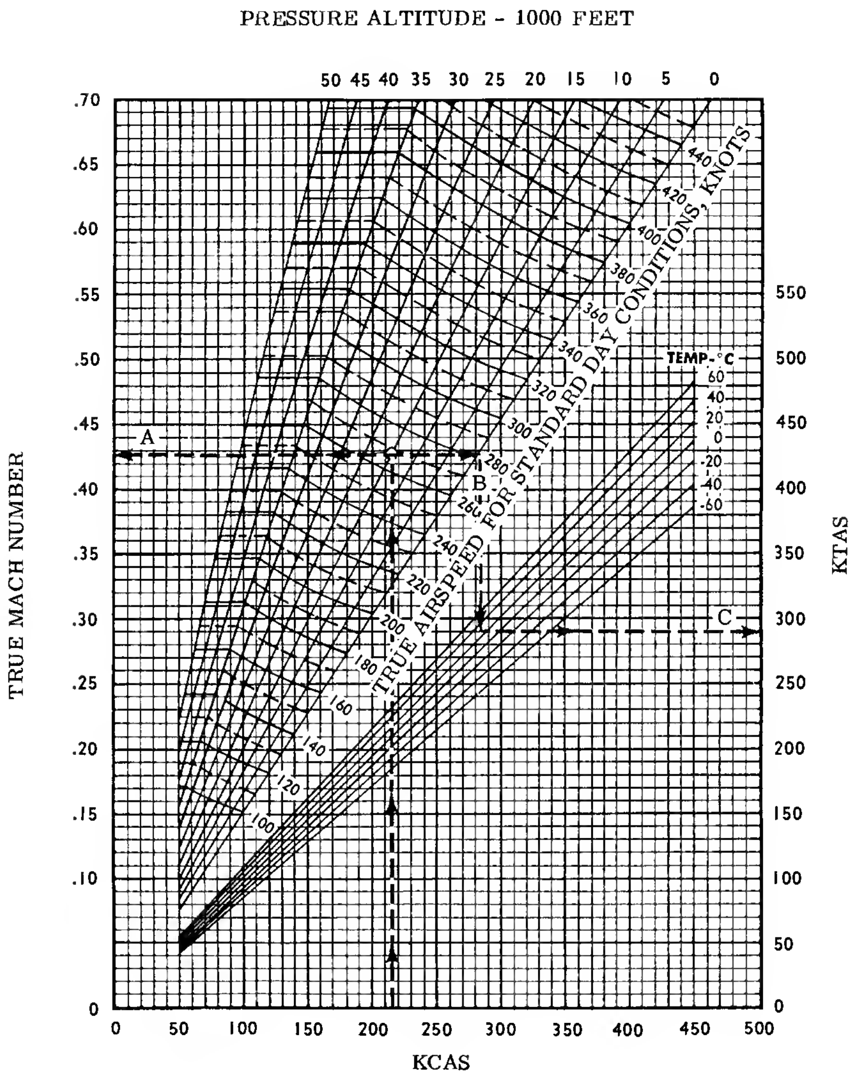


Figure A1-3

SPEED CONVERSION CHART



EXAMPLE: CAS = 215 Knots
Alt = 15,000 Feet
(a) TMN = .428
(b) TAS = 267 Knots at Standard Temp (-14.7°C)
(c) TAS = 290 Knots at temp of 30°C

Figure A1-4

DENSITY ALTITUDE CHART

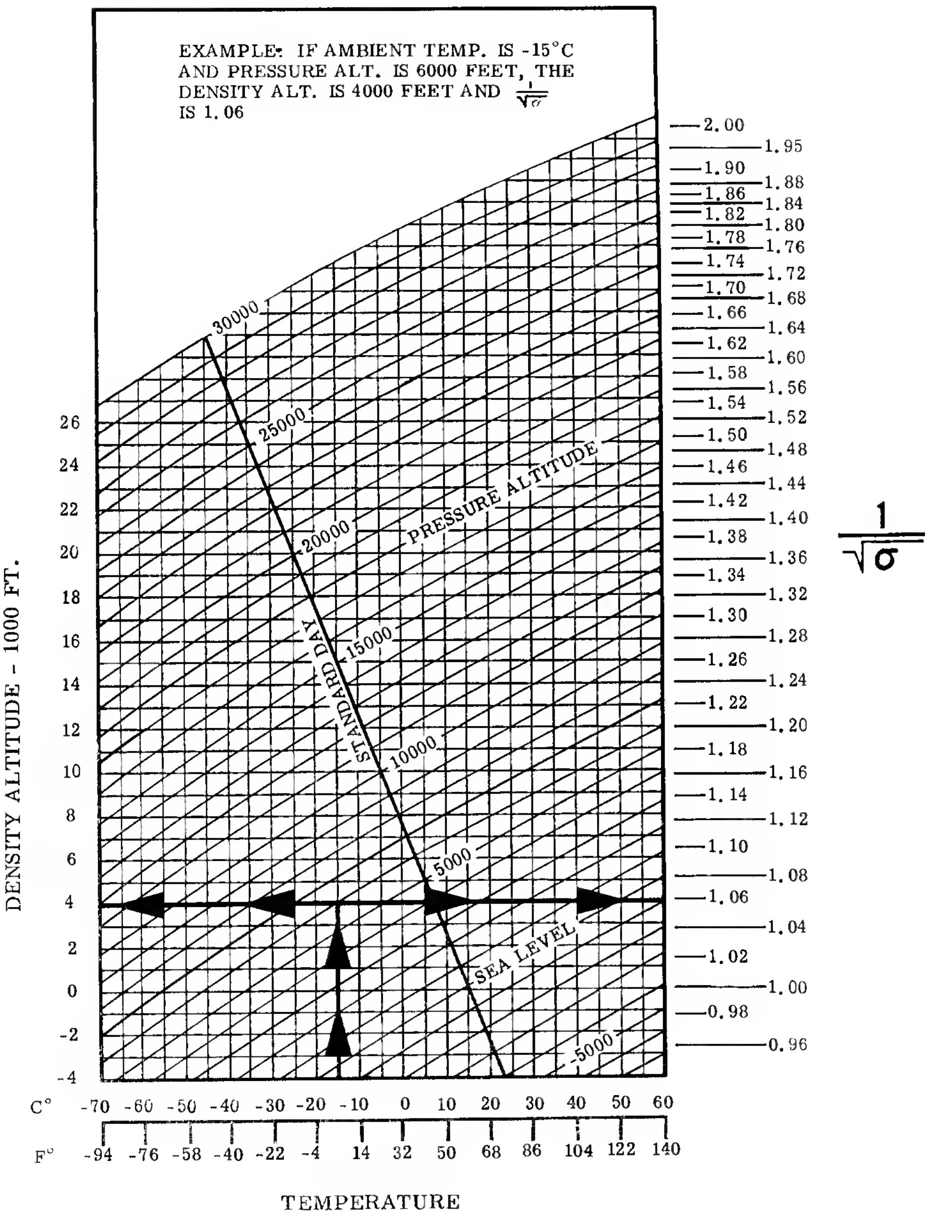


Figure A1-5

STANDARD ATMOSPHERIC TABLE

Standard Sea Level Conditions:
T - 15 °C (59° F)
P = 29. 921 in. of Hg. (2116. 216 lb/sq. ft.)
Density = . 0023769 Slugs/Cu. ft.
Speed of Sound 1116. 89 Ft. /sec. (661. 7 Knots)

Conversion Factors:
1 In. Hg = 70. 727 lb/sq. ft. = 0. 4412 lb/sq. in.
1 Knot = 1. 151 MPH = 1. 688 ft/sec.

Altitude feet	Density Ratio $\sigma = \rho/\rho_0$	Smoe Factor $\frac{1}{\sqrt{\sigma}}$	Temperature Deg. C	Temperature Deg. F	Speed of Sound (Knots)	Pressure In. of Hg.	Pressure Ratio $\delta = p/p_0$
0	1. 0000	1. 0000	15. 000	59. 000	661. 7	29. 92	1. 0000
1000	. 9710	1. 0148	13. 019	55. 434	659. 5	28. 86	. 9644
2000	. 9428	1. 0299	11. 038	51. 868	657. 2	27. 82	. 9298
3000	. 9151	1. 0454	9. 056	48. 301	654. 9	26. 81	. 8962
4000	. 8881	1. 0611	7. 075	44. 735	652. 6	25. 84	. 8636
5000	. 8616	1. 0773	5. 094	41. 169	650. 3	24. 89	. 8320
6000	. 8358	1. 0938	3. 113	37. 603	647. 9	23. 98	. 8013
7000	. 8106	1. 1107	1. 132	34. 037	645. 6	23. 09	. 7716
8000	. 7859	1. 1280	-0. 850	30. 471	643. 3	22. 22	. 7427
9000	. 7619	1. 1456	-2. 831	26. 904	640. 9	21. 38	. 7147
10000	. 7384	1. 1637	-4. 812	23. 338	638. 6	20. 58	. 6876
11000	. 7154	1. 1822	-6. 793	19. 772	636. 2	19. 79	. 6614
12000	. 6931	1. 2012	-8. 774	16. 206	633. 9	19. 03	. 6359
13000	. 6712	1. 2206	-10. 756	12. 640	631. 5	18. 29	. 6112
14000	. 6499	1. 2404	-12. 737	9. 074	629. 1	17. 57	. 5873
15000	. 6291	1. 2608	-14. 718	5. 507	626. 7	16. 88	. 5642
16000	. 6088	1. 2816	-16. 699	1. 941	624. 3	16. 21	. 5418
17000	. 5891	1. 3029	-18. 680	-1. 625	621. 9	15. 56	. 5202
18000	. 5698	1. 3247	-20. 662	-5. 191	619. 4	14. 94	. 4992
19000	. 5509	1. 3473	-22. 643	-8. 757	617. 0	14. 33	. 4790
20000	. 5327	1. 3701	-24. 624	-12. 323	619. 6	13. 75	. 4594
21000	. 5148	1. 3937	-26. 605	-15. 890	612. 1	13. 18	. 4405
22000	. 4974	1. 4179	-28. 586	-19. 456	609. 6	12. 63	. 4222
23000	. 4805	1. 4426	-30. 568	-23. 022	607. 2	12. 10	. 4045
24000	. 4640	1. 4681	-32. 549	-26. 588	604. 7	11. 59	. 3874
25000	. 4480	1. 4940	-34. 530	-30. 154	602. 2	11. 10	. 3709
26000	. 4323	1. 5209	-36. 511	-33. 720	599. 7	10. 62	. 3550
27000	. 4171	1. 5484	-38. 493	-37. 287	597. 2	10. 16	. 3397
28000	. 4023	1. 5768	-40. 474	-40. 853	594. 6	9. 720	. 3248
29000	. 3879	1. 6056	-42. 455	-44. 419	592. 1	9. 293	. 3106
30000	. 3740	1. 6352	-44. 436	-47. 985	589. 6	8. 880	. 2968
31000	. 3603	1. 6359	-46. 417	-51. 551	587. 0	8. 483	. 2834
32000	. 3472	1. 6971	-48. 399	-55. 117	584. 4	8. 101	. 2707
33000	. 3343	1. 7295	-50. 379	-58. 684	581. 8	7. 732	. 2583
34000	. 3218	1. 7628	-52. 361	-62. 250	579. 3	7. 377	. 2465
35000	. 3098	1. 7966	-54. 342	-65. 815	576. 7	7. 036	. 2352

Figure A1-6

STORES DRAG INDEX

STORE	TYPE	WEIGHT POUNDS	DRAG INDEX L1-R1, L2-R2, L3-R3: NO ADJACENT STORE	DRAG INDEX L1-R1, L2-R2, L3-R3: ONE ADJACENT STORE	DRAG INDEX L1-R1, L2-R2, L3-R3: TWO ADJACENT STORES	DRAG INDEX L4-R4: NO ADJACENT STORE	DRAG INDEX L4-R4: ONE ADJACENT STORE
AN-M47A4	WP BOMB	130	6	6	6	6	6
B-37K-1	PRACTICE BOMB CONTAINER RACK WITH BDU-33/B BOMB — FULL EMPTY	175 80	22	22	22	22	22
BLU-1C/B	FIRE BOMB	697	16	26	36		
BLU-23/B	FIRE BOMB	490	12	14	17		
BLU-27/B	FIRE BOMB	870	16	26	36		
BLU-32/B	FIRE BOMB	589	12	14	17		
CBU-14/A CBU-14A/A	DISPENSER & BOMB — FULL EMPTY	250 50	37	37	37	37	37
CBU-19/A	CANISTER CLUSTER	130		63	63	63	63
CBU-22/A CBU-22A/A	DISPENSER & BOMB — FULL EMPTY	226 50	37	37	37	37	37
CBU-24A/B CBU-29A/B	DISPENSER & BOMB	830	15	19	24		
CBU-25/A CBU-25A/A	DISPENSER & BOMB — FULL EMPTY	264 50	37	37	37	37	37
DROP TANK	FUEL-100 GAL	735	16	26	36		
LAU-3/A	ROCKET LAUNCHER	427	13	16	19		
LAU-3/A	ROCKET LAUNCHER EMPTY	71	49	64	76		
LAU-32A/A LAU-32B/A LAU-59/A	ROCKET LAUNCHER	174 177 181	6	6	6	6	6
LAU-32A/A LAU-32B/A LAU-59/A	ROCKET LAUNCHER	47 50 54	15	15	15	15	15
M117 M117A1	GP BOMB	823	16	20	25		
MK-81	GP BOMB	260	6	6	6	6	6
MK-82	GP BOMB	531	7	7	7		
MK-82 (SNAKEYE 1)	GP BOMB	560	8	8	8		
SUU-11A/A	GUNPOD — FULL EMPTY	325 245	8	8	8	8	8
SUU-20	BOMB & ROCKET DISPENSER — BDU-33/B & ROCKETS MK MK-106 & ROCKETS EMPTY	465 340 240	10	15	20		
SUU-25/A SUU-25A/A	FLARE DISPENSER — FULL EMPTY	340 121	9	10	10	10	10

NOTES:

1. CLEAN AIRCRAFT DRAG INDEX = 0. (INCLUDES PYLONS AND TIP TANKS)
2. USE OF OUTBOARD PYLONS LIMITED TO TIP TANKS EMPTY OPERATIONS ONLY.

Figure A1-7

PART II — TAKE OFF

TABLE OF CONTENTS

TAKEOFF AND LANDING CROSSWIND CHART

The Takeoff and Landing Crosswind Chart (figure A2-1) is used to resolve the prevailing wind into headwind and crosswind components and to determine the minimum nose wheel lift-off and main gear touchdown speed and configuration for the crosswind component. The speed obtained from the chart is the lowest speed that a heading and course along the runway can be maintained with full rudder and ailerons deflected, when the nose wheel is off the runway. A maximum of 110 knots IAS is recommended for nose wheel lift-off speed. A maximum of 100 knots IAS is recommended for main gear touchdown speed with zero flaps.

SAMPLE PROBLEM:

The wind is from 40° at 20 knots with gusts to 32 knots. Runway 01 is the active runway. Find the headwind and crosswind components and the minimum nose wheel lift-off and main gear touchdown speed and configuration.

SOLUTION: (See figure A2-1)

Wind direction from runway 40° - 10° = 30°.

A. Is maximum gust velocity (32 knots) at wind direction from centerline of runway (30°).

Note

Use maximum reported gust velocity for determining crosswind component and minimum nose wheel lift-off and main gear touchdown speed and configuration. Use reported steady wind velocity for determining headwind component.

B. Proceed down and read crosswind component (16 knots)

C. Proceed up along crosswind component line to intersection of guide line

D. Proceed to the right and read minimum nose wheel lift-off and main gear touchdown speed (90 knots) and recommended landing configuration (50% flaps)

Note

Since the maximum main gear touchdown speed with 100% flaps is 85 knots, landing must be made with no more than 50% flaps.

E. Is reported steady wind velocity (20 knots)
F. Is headwind component (17 knots)

Note

If crosswind component falls short of guide line, use 65 KIAS for minimum nose wheel lift-off speed.

TAKEOFF SPEEDS

The Takeoff Speed Chart (figure A2-2) gives the indicated airspeeds for stall and initial stall warning as a function of gross weight. The charts also include speeds for takeoff and climb for minimum distance to clear a 50 foot obstacle.

SAMPLE PROBLEM:

Gross weight is 11, 000 lbs. Find the Takeoff speed.

SOLUTION: (See figure A2-2)

A. Is takeoff gross weight (11, 000 lbs.)
B. Is takeoff speed (91.2 KIAS)

NORMAL TAKEOFF DISTANCE

The Normal Takeoff Distance Chart (figure A2-3) is used to determine the ground run and total distance required to clear obstacles up to 200 feet high. The ground run is defined as the distances along the runway from the start of the takeoff run to the point where the aircraft leaves the ground. The total distance to clear an obstacle is the distance along the runway from the start of the takeoff run to the point where the obstacle height is reached.

Distances may be determined for various atmospheric conditions, gross weight, wind conditions, runway slope and obstacle height. The distances are based on using 100% flaps, 100% rpm.

If takeoff speed exceeds normal takeoff speed, instructions for computing takeoff distance is covered under Velocity During Takeoff Ground Run, figure A2-7.

Pilots are not required to complete takeoff and landing data cards if the runway available is 4,000 feet long with a pressure altitude not exceeding 5,000 feet.

SAMPLE PROBLEM:

It is desired to lead a formation takeoff with the following conditions:

Temperature 21 °C
Pressure altitude 4000 feet
Gross weight 11, 000 lbs.
Headwind component 23 knots
The active runway has a 1% uphill grade and is 5000 feet long
Find the distance required to clear a 50-foot obstacle.

SOLUTION: (See figure A2-3)

A. Is temperature (21 °C)
B. Is pressure altitude (4000 feet)
C. Is gross weight 11, 000 lbs.
D. Is wind base line
E. Is headwind component (23 knots)
F. Is slope base line
G. Is runway grade (1% uphill)
H. Is ground run with 100% rpm (1170 feet)
   The ground run using 98% rpm is then
   1170 feet x 1. 08 = 1265 feet
I. Is obstacle height
J. Is total distance to 50 feet altitude with 100% rpm (1830)
   The total distance to 50 feet altitude using 98% rpm is then:
   1830 feet x 1. 08 = 1980 feet

CRITICAL FIELD LENGTH

The Critical Field Length Chart (figure A2-4) gives the length of runway required to accelerate to the critical engine failure speed on two engines with 100% rpm and then, in case of engine failure, either continue the takeoff on single engine or abort the takeoff and stop. Critical engine failure speed is defined as the speed at which engine failure permits acceleration to takeoff speed on the remaining engine in the same distance that the aircraft may be decelerated to a stop.

The chart assumes a three-second delay for reaction time and the use of normal braking with idle rpm. If 98% rpm is to be used for takeoff, the critical field length is increased by 10%.

SAMPLE PROBLEM:

The sample conditions used under NORMAL TAKEOFF DISTANCE are continued. Find the critical field length.

SOLUTION: (See figure A2-4)

A. Is temperature (21 °C)
B. Is pressure altitude (4000 feet)
C. Is gross weight (11, 000 lbs.)
D. Is runway condition (dry runway)
E. Is wind base line
F. Is headwind component (23 knots)
G. Is critical field length using 100% rpm (1820 feet)
   The critical field length using 98% rpm is then 1820 feet x 1. 10 = 2002 feet

REFUSAL SPEEDS

The highest indicated airspeed to which an aircraft can accelerate and then be stopped in the available runway remaining is called the refusal speed. This speed may be determined from the Refusal Speed Chart (figure A2-5) for existing takeoff conditions and runway length. The chart is based on a 100% rpm acceleration to the refusal speed and normal braking to complete stop. A three-second delay for reaction time is included. The stopping distance for figure A2-5 is based on a dry, hard surface runway and idle rpm. For wet or icy conditions the stopping distance is increased and the corrected refusal speed is obtained from figure A2-6. If 98% rpm is used for takeoff, reduce the effective runway length by 3%.

SAMPLE PROBLEM: (See figure A2-5)

The sample conditions used under NORMAL TAKEOFF DISTANCE are continued. Find the refusal speed.

SOLUTION: (See figure A2-5)

A. Is actual runway length (5000 feet)
B. Is headwind component (23 knots)
C. Is effective runway length (8750 feet) using 100% rpm for takeoff
   The effective runway length using 98% rpm for takeoff is then:
   8750 feet - 263 feet = 8487 feet
D. Is gross weight (11, 000 lbs.)
E. Is pressure altitude (4000 feet)
F. Is temperature (20°C)
G. Is refusal speed (95 KIAS)

SAMPLE PROBLEM: (See figure A2-6)

For the sample conditions above find the corrected refusal speed for a wet runway.

SOLUTION:

A. Is wet runway refusal speed (95 KIAS)
B. Is runway condition (wet)
C. Is corrected refusal speed (83KIAS)

The critical engine failure speed may also be determined from the Refusal Speed Chart.
Since at this speed either the aircraft may be stopped or the takeoff executed on single engine in the same distance, the critical engine failure speed may be determined by considering the critical field length (from figure A2-4) as the effective runway length.

VELOCITY DURING TAKEOFF GROUND RUN

The Velocity During Takeoff Ground Run Chart (figure A2-7) is used to minitor the aircraft speed at fixed points along the runway during the takeoff ground run. The normal speed at any point along the runway may be determined by first determining the distance required to attain the normal takeoff speed for the prevailing conditions and following the guide lines to the fixed point distance.

SAMPLE PROBLEM:

The takeoff ground run (from figure A2-3) for the prevailing conditions is determined to be 1170 feet. Find the normal speed after 800 feet of ground run.

SOLUTION: (See figure A2-7)

A. Is normal takeoff ground run (1170 feet)
B. Is normal takeoff speed (91. 2 KIAS)
C. Is distance at which normal speed is to be determined (800 feet)
D. Is guide line
E. Is normal speed after 800 feet of ground run (81 KIAS)

If normal takeoff speed exceeds 91. 2 KIAS, compute takeoff distance using the Velocity During Takeoff Ground Run Chart (figure A2-7). Enter the chart with the normal takeoff distance. Proceed horizontally to the normal takeoff speed line (91. 2 KIAS). Proceed up and to the right on the guide lines until intersecting the computed takeoff speed. Proceed horizontally to the left to find takeoff distance.

SAMPLE PROBLEM:

Normal takeoff distance of 1175 feet. Takeoff speed of 100 KIAS.

SOLUTION: (See figure A2-7)

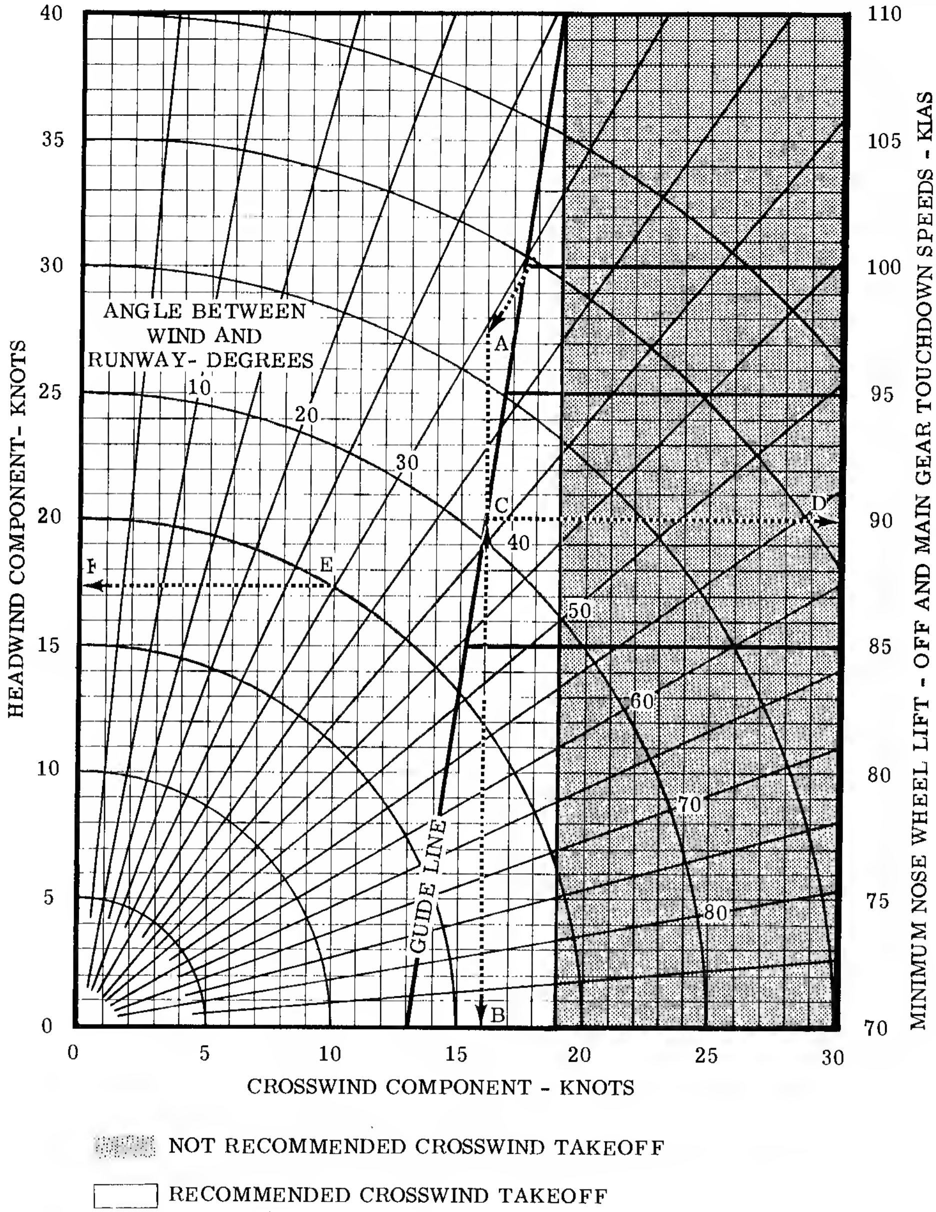
A. Is normal takeoff ground run (1175 feet)
B. Is normal takeoff speed (91. 2 KIAS).
F. Is actual takeoff speed (100 KIAS)
G. Is actual takeoff ground run (1550 feet)

TAKEOFF AND LANDING CROSSWIND CHART

ALL FLAP SETTINGS
MAXIMUM (FULL RUDDER DEFLECTION) SIDESLIP

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



Note

Enter chart with steady wind to determine headwind component and with maximum gust velocity to determine crosswind component.

Figure A2-1

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

TAKE-OFF SPEED

MAXIMUM THRUST
100% FLAPS

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

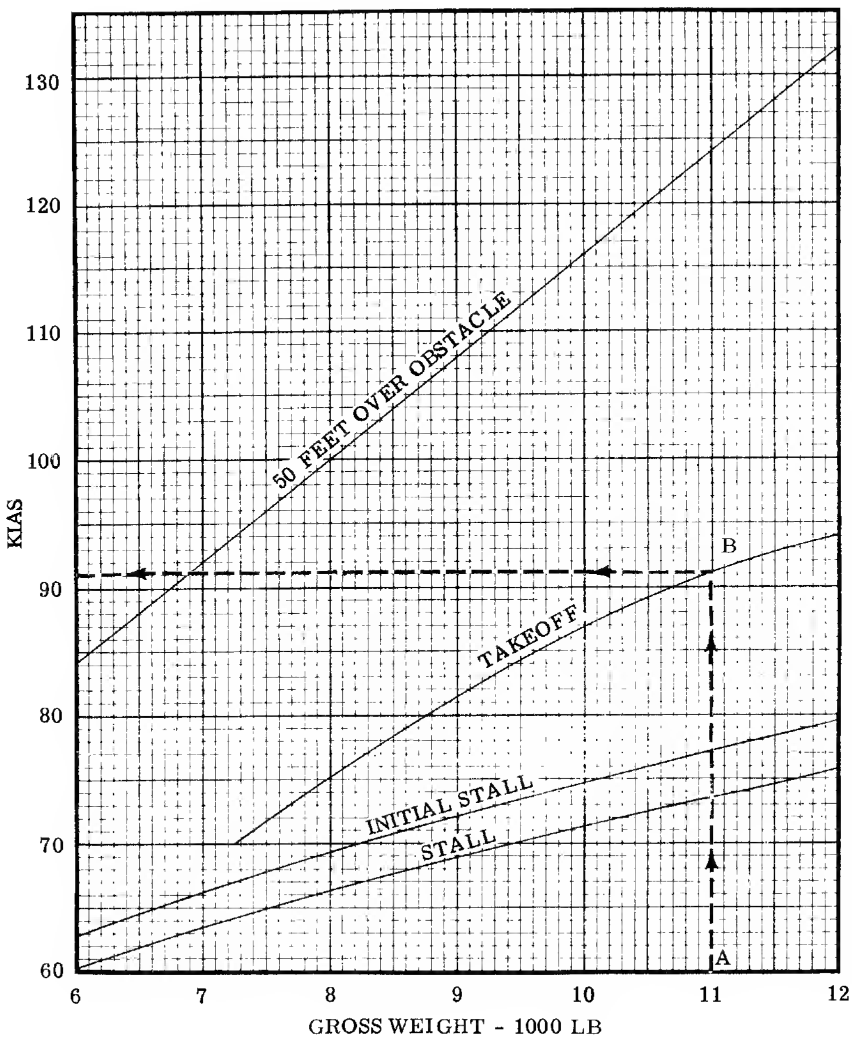


Figure A2-2

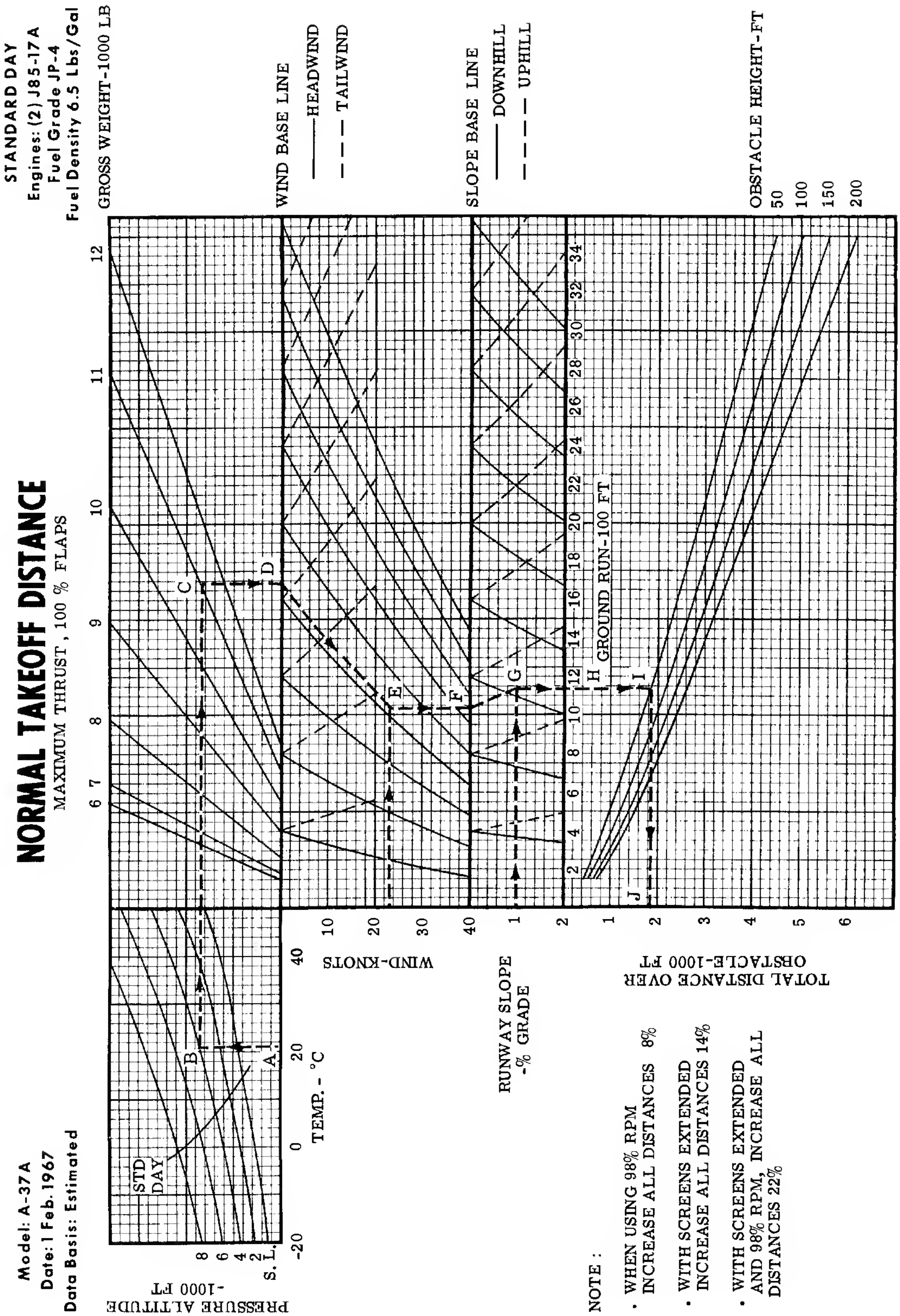


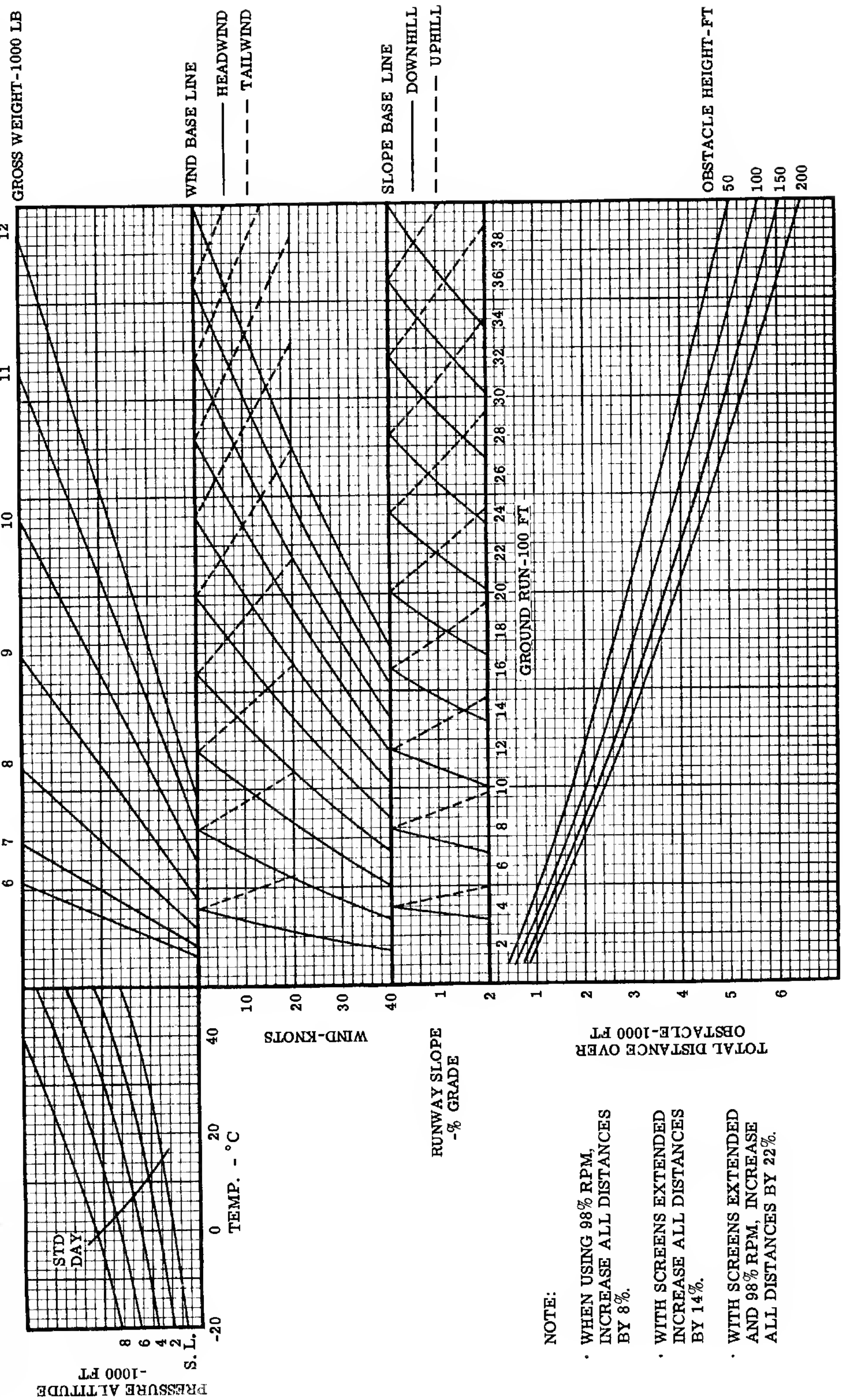
Figure A2-3 (Sheet 1 of 3)

NORMAL TAKEOFF DISTANCE

MAXIMUM THRUST, 50% FLAPS

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated



NOTE:

- WHEN USING 98% RPM, INCREASE ALL DISTANCES BY 8%.
- WITH SCREENS EXTENDED INCREASE ALL DISTANCES BY 14%.
- WITH SCREENS EXTENDED AND 98% RPM, INCREASE ALL DISTANCES BY 22%.

Figure A2-3 (Sheet 2 of 3)

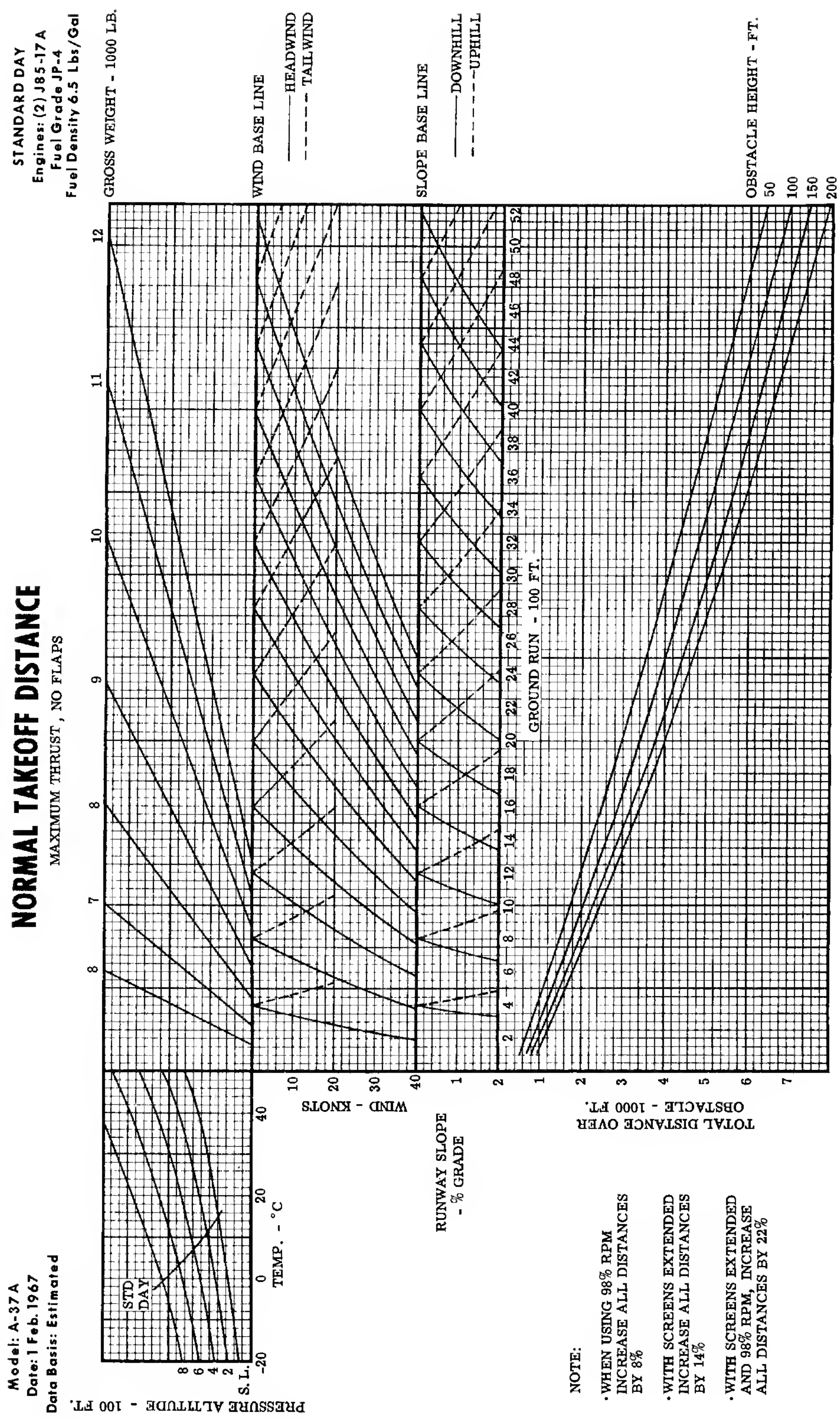


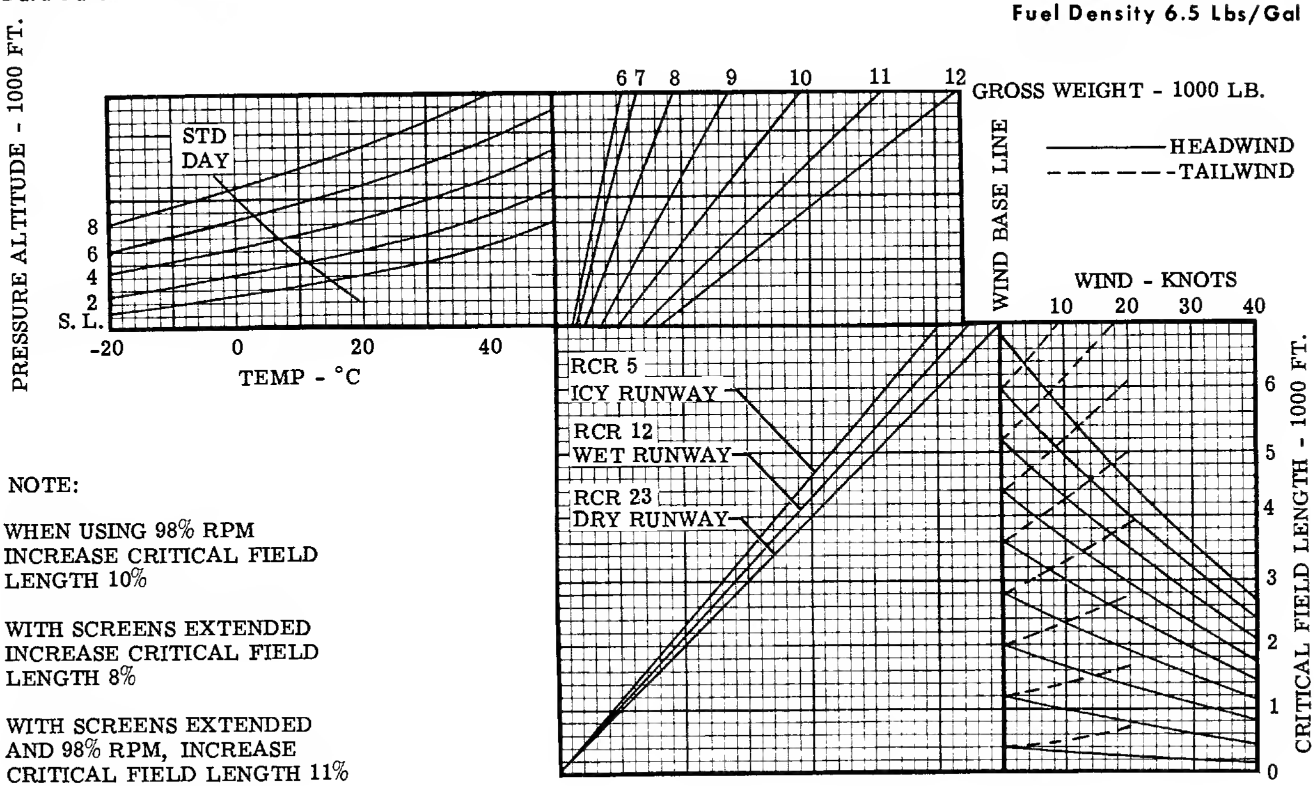
Figure A2-3 (Sheet 3 of 3)

CRITICAL FIELD LENGTH

MAXIMUM THRUST, 100% FLAPS

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



NOTE:

- WHEN USING 98% RPM INCREASE CRITICAL FIELD LENGTH 10%
- WITH SCREENS EXTENDED INCREASE CRITICAL FIELD LENGTH 8%
- WITH SCREENS EXTENDED AND 98% RPM, INCREASE CRITICAL FIELD LENGTH 11%

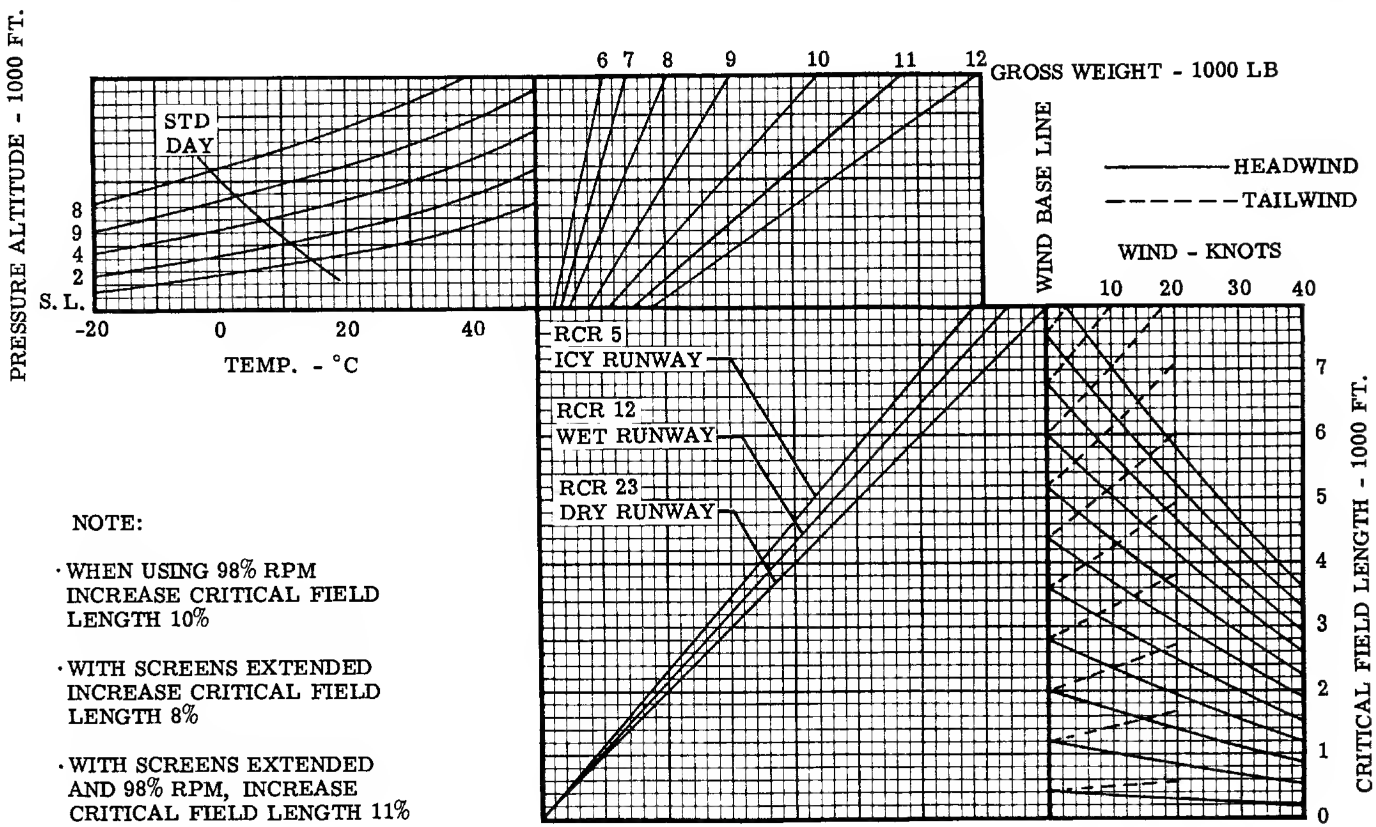
Figure A2-4 (Sheet 1 of 3)

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

CRITICAL FIELD LENGTH

MAXIMUM THRUST, 50% FLAPS

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



NOTE:

- WHEN USING 98% RPM INCREASE CRITICAL FIELD LENGTH 10%
- WITH SCREENS EXTENDED INCREASE CRITICAL FIELD LENGTH 8%
- WITH SCREENS EXTENDED AND 98% RPM, INCREASE CRITICAL FIELD LENGTH 11%

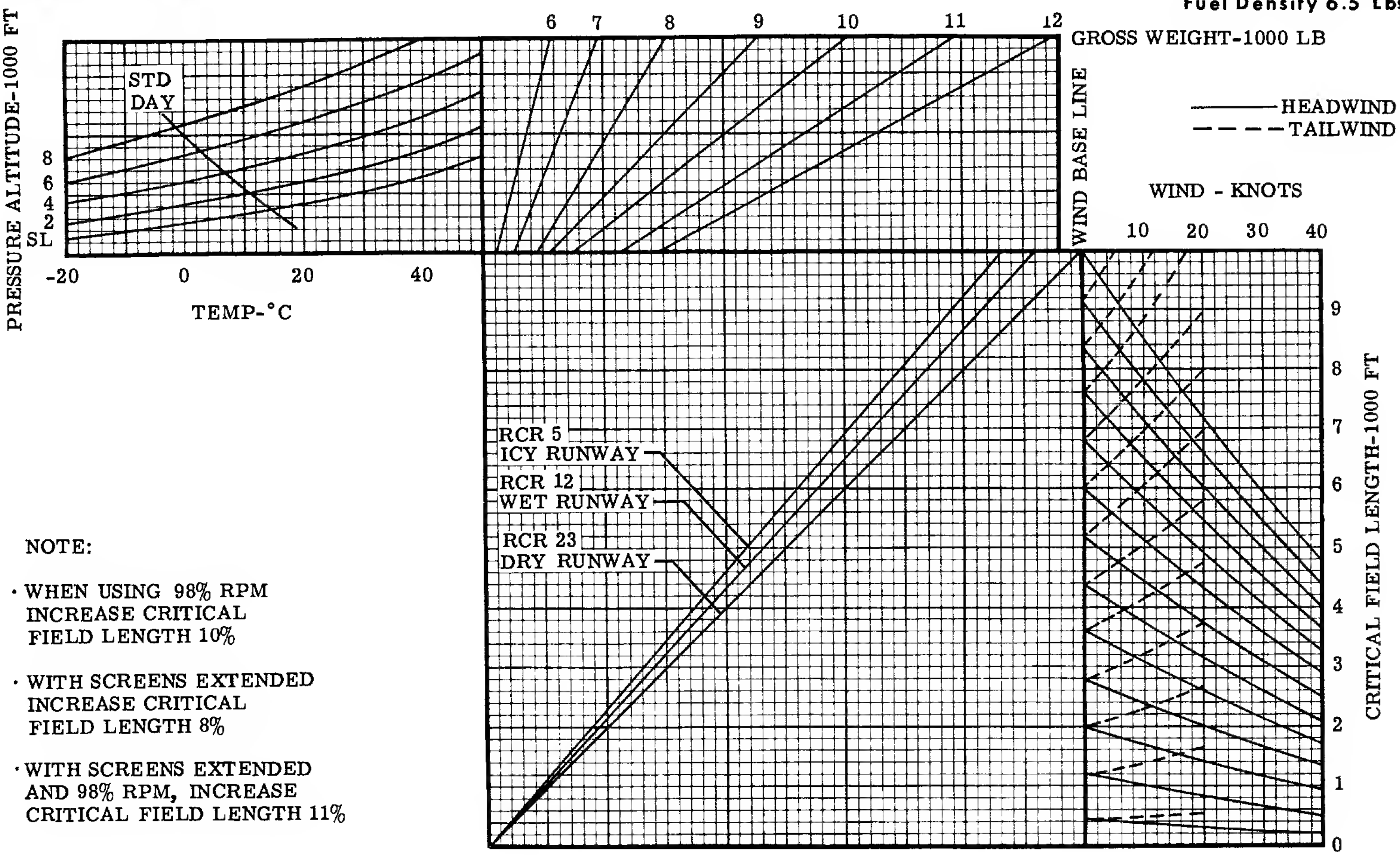
Figure A2-4 (Sheet 2 of 3)

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

CRITICAL FIELD LENGTH

MAXIMUM THRUST, NO FLAPS

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



NOTE:

- WHEN USING 98% RPM INCREASE CRITICAL FIELD LENGTH 10%
- WITH SCREENS EXTENDED INCREASE CRITICAL FIELD LENGTH 8%
- WITH SCREENS EXTENDED AND 98% RPM, INCREASE CRITICAL FIELD LENGTH 11%

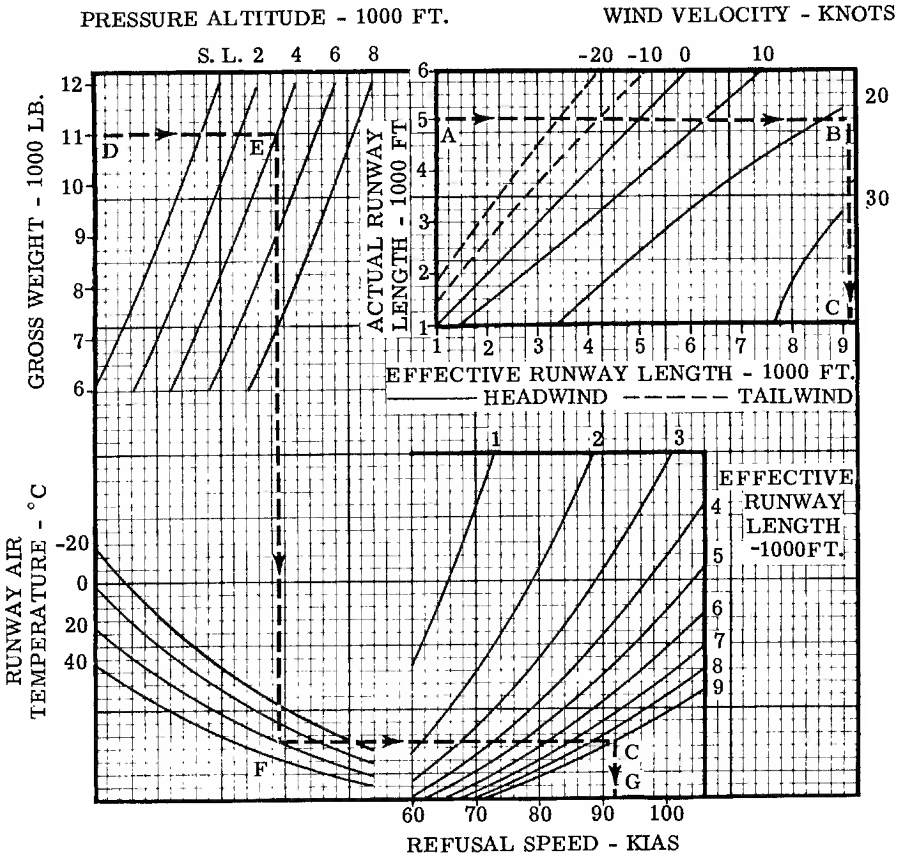
Figure A2-4 (Sheet 3 of 3)

REFUSAL SPEED

MAXIMUM THRUST
ALL FLAP SETTINGS
RCR 23

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



NOTE:

- WHEN USING 98% RPM DECREASE EFFECTIVE RUNWAY LENGTH 3%
- WITH SCREENS EXTENDED DECREASE EFFECTIVE RUNWAY LENGTH 4%
- WITH SCREENS EXTENDED AND 98% RPM DECREASE EFFECTIVE RUNWAY LENGTH 6%

Figure A2-5

CORRECTION TO REFUSAL SPEED FOR RUNWAY CONDITION

ALL FLAP SETTINGS

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

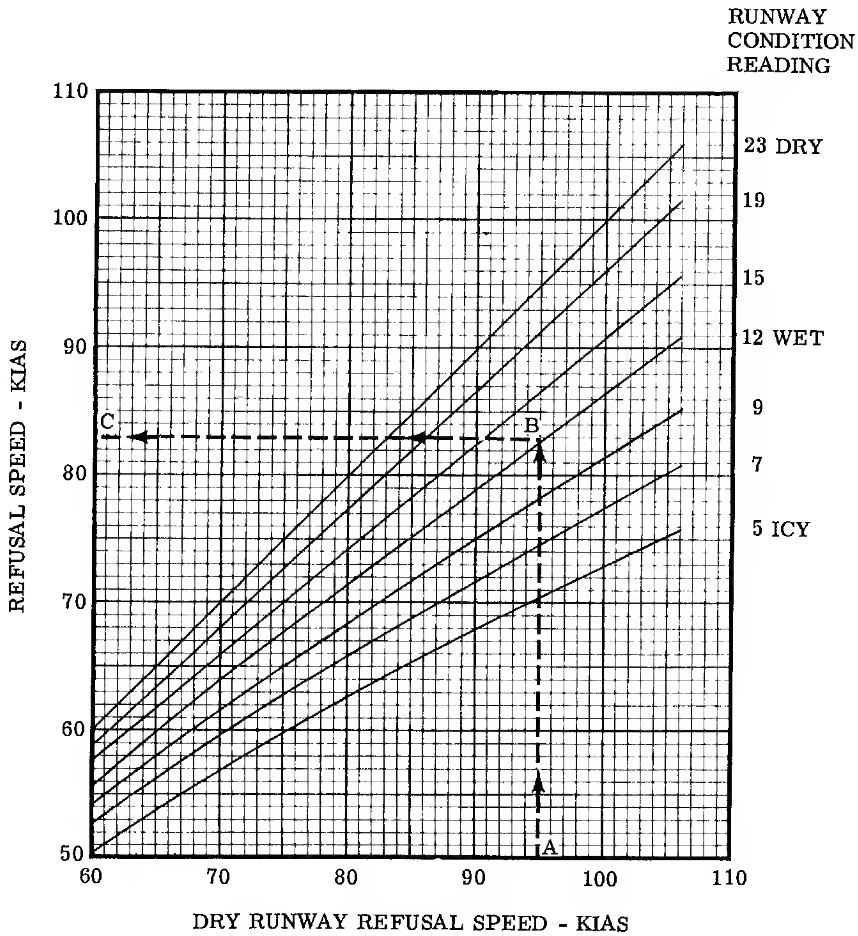


Figure A2-6

VELOCITY DURING TAKE-OFF GROUND RUN

Model: A-37 A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17 A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

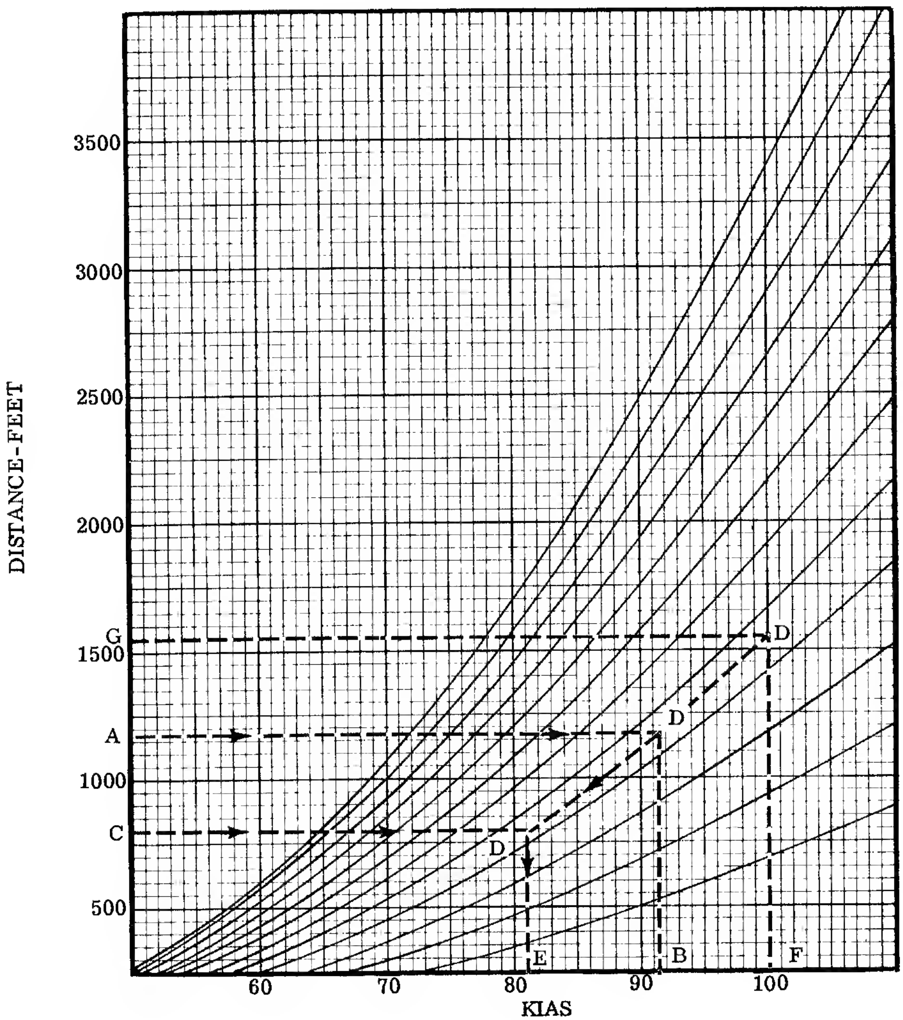


Figure A2-7

PART III — CLIMB

TABLE OF CONTENTS

CLIMB PERFORMANCE

The Climb Performance Charts (figures A3-1 thru A3-3) two engine and (figures A3-4 thru A3-6) single engine are used to determine the fuel consumed, time elapsed, and horizontal air distance traveled during an "on course" climb. The charts assume adherence to the climb speed schedules shown in figure A3-1 (two engines) and figure A3-4 (single engine) and full throttle at all altitudes. At altitudes above 15, 000 feet, full throttle may be slightly less than 100% rpm. This condition is normal and has been accounted for in the charts.

USE

For a climb from sea level the charts are entered with initial gross weight, final altitude and temperature deviation from standard day, and the fuel used, time to climb and horizontal distance traveled are read directly. To climb from an initial altitude other than sea level, the fuel used, time and distance are the difference between those quantities for a climb from sea level to the final altitude, and a climb from sea level to the actual initial altitude.

EXAMPLE:

Conditions:

Initial altitude	2500 ft
Initial gross weight	11, 000 lb
Temperature at initial altitude	25° C
Final altitude	20, 000 ft
Temperature at final altitude	-15°C
Drag Index	100

Find: Fuel used, time to climb, horizontal distance traveled.

SOLUTION: (See figures A3-2 and A3-3)

1. Determine temperature deviation (Δ Temp) at final altitude:
   Reported temperature at 20, 000 ft: -15° C
   Standard day temperature at 20, 000 ft: -25° C
   Temperature deviation: 25 -15 = 10° C (Hotter)

2. Enter figure A3-2:
   At initial gross weight = 11, 000 lb (A)
   Move horizontally to altitude = 20000 ft (B)
   Drop vertically to drag index line (C)
   Move horizontally to base line (D)
   Move parallel to "Hotter" guide lines to Δ Temp = 10° C (E)
   Move horizontally to the fuel used scale and read fuel used = 295 lb (F)

3. Enter figure A3-3:
   At initial gross weight = 11, 000 lb (G)
   Move horizontally to altitude = 20, 000 ft (H)
   Drop vertically to drag index line (I)
   Move horizontally to base line (J)
   Move parallel to "Hotter" guide lines to Δ Temp = 10°C (K)
   Move horizontally to the time scale and read time = 4. 8 min (L)
   Drop vertically from (I) to drag index line (M)
   Move horizontally to base line (N)
   Move parallel to "Hotter" guide lines to Δ Temp = 10° C (O)
   Move horizontally to the distance scale and read distance = 19 Naut mi (P)

4. Determine temperature deviation (Δ Temp) at initial altitude:
   Reported temperature at 2500 ft: 25° C
   Standard Day temperature at 2500 ft: 10° C
   Temperature deviation: 25 -10 = 15° C (hotter)

5. Re-enter figures A3-2 and A3-3 and repeat steps (A) through (P) using Altitude = 2500 ft and Δ Temp = 15° C hotter. Read:
   Fuel used = 39 lb
   Time = . 6 min
   Distance = 3. 8 Naut mi

6. Determine fuel used from 2500 ft to 20, 000 ft:
   Fuel used from sea level to 20, 000 ft: 295 lb
   Fuel used from sea level to 2500 ft: 39 lb
   Fuel used: 295 -39 =241 lb

7. Determine time to climb from 2500 ft to 20, 000 ft:
   Time from sea level to 20, 000 ft: 4. 8 minutes
   Time from sea level to 2500 ft: . 6 minute
   Time to climb: 4. 8 - . 6 = 4. 2 minutes

8. Determine horizontal distance traveled in climb from 2500 ft to 20, 000 ft:
   Distance to climb from sea level to 20, 000 ft:
   19 Naut miles
   Distance to climb from sea level to 2500 ft:
   3. 8 Naut miles
   Horizontal distance traveled in climb:
   19 -3. 8 = 15. 2 Naut miles

The climb speed schedule to be followed is taken from figure A3-1.

BEST CLIMB SPEED

TWO ENGINES
MAXIMUM THRUST

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

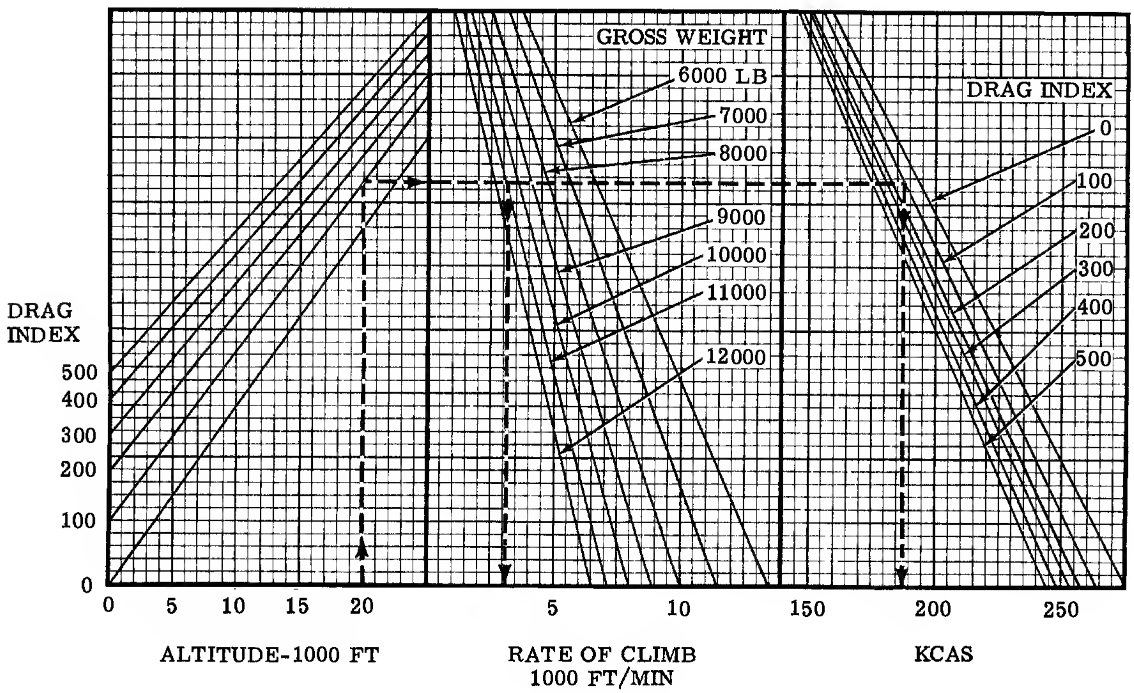


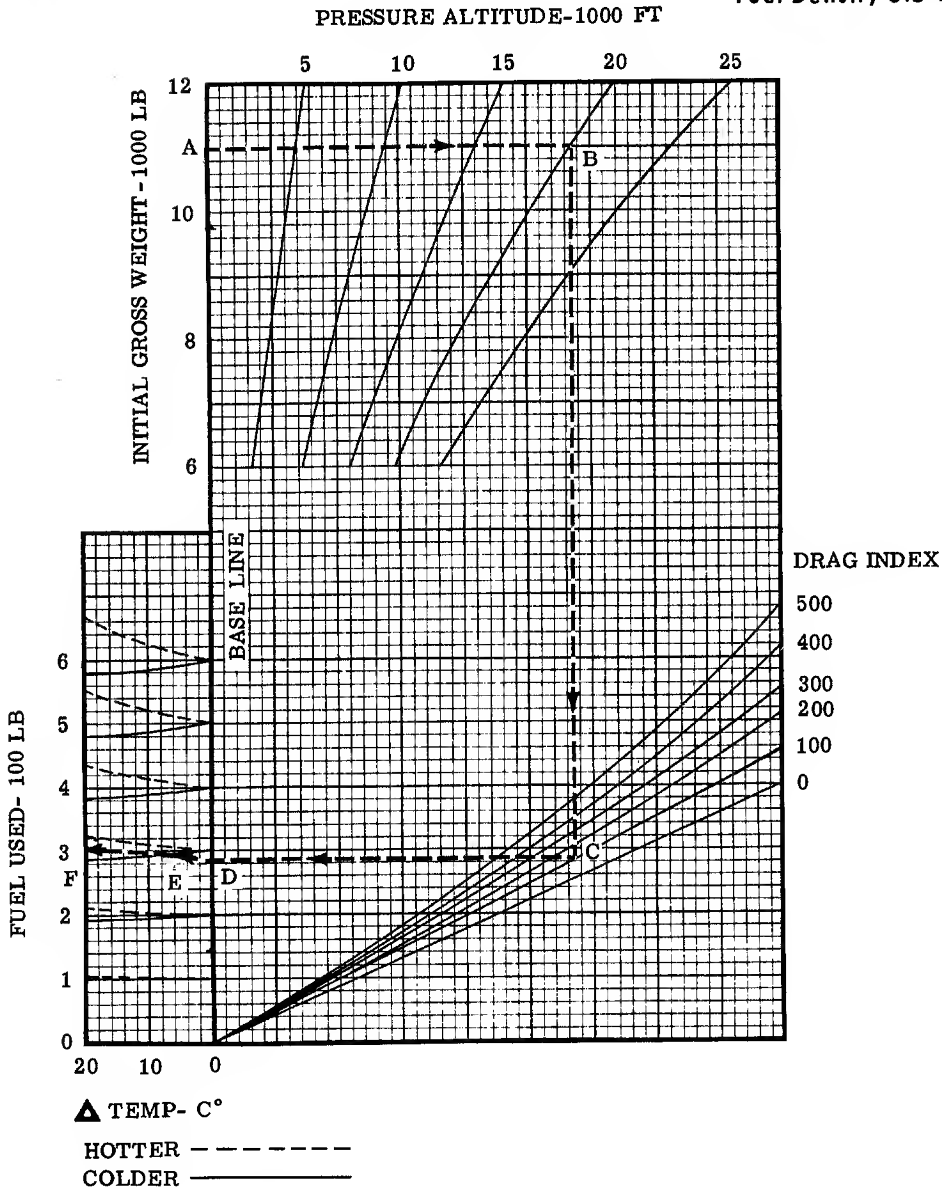
Figure A3-1

FUEL USED TO CLIMB

TWO ENGINES
MAXIMUM THRUST

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



Note

Allow 300 pounds fuel for engine start, taxi, takeoff and acceleration to climb speed.

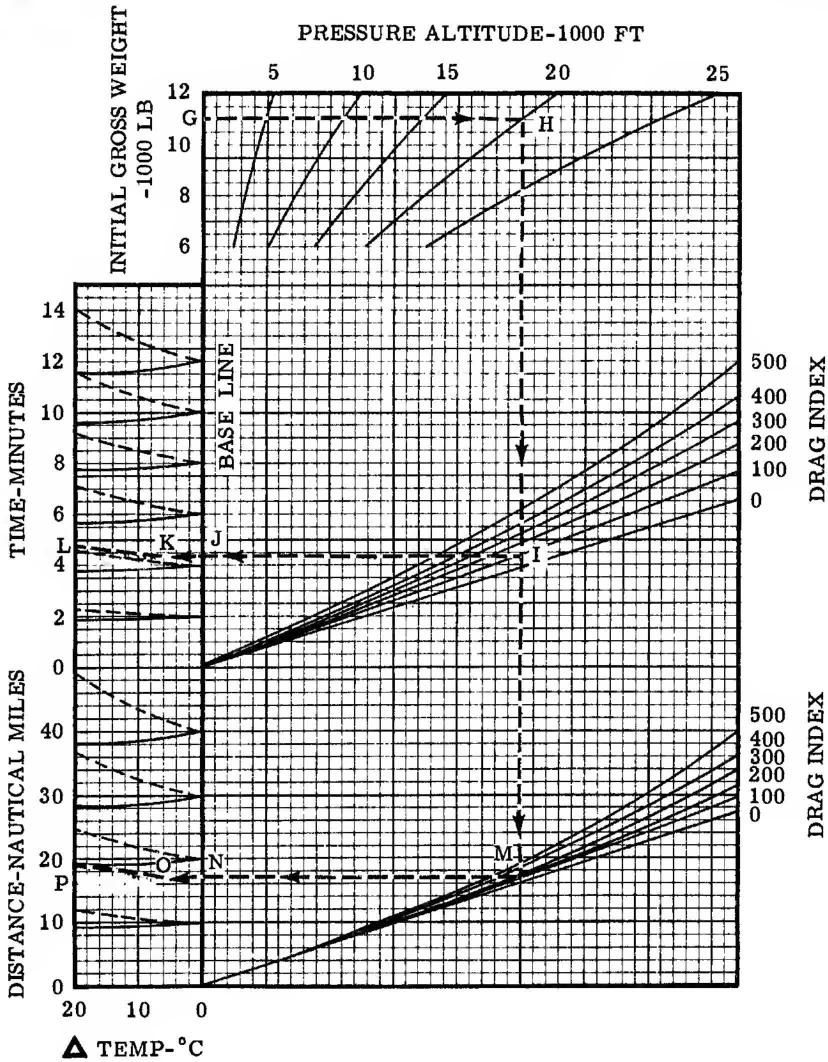
Figure A3-2

TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED DURING CLIMB

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

TWO ENGINES
MAXIMUM THRUST

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



Note

Allow 300 pounds fuel for engine start, taxi, takeoff and acceleration to climb speed.

Figure A3-3

BEST CLIMB SPEED AND RATE OF CLIMB

SINGLE ENGINE
MAXIMUM THRUST

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

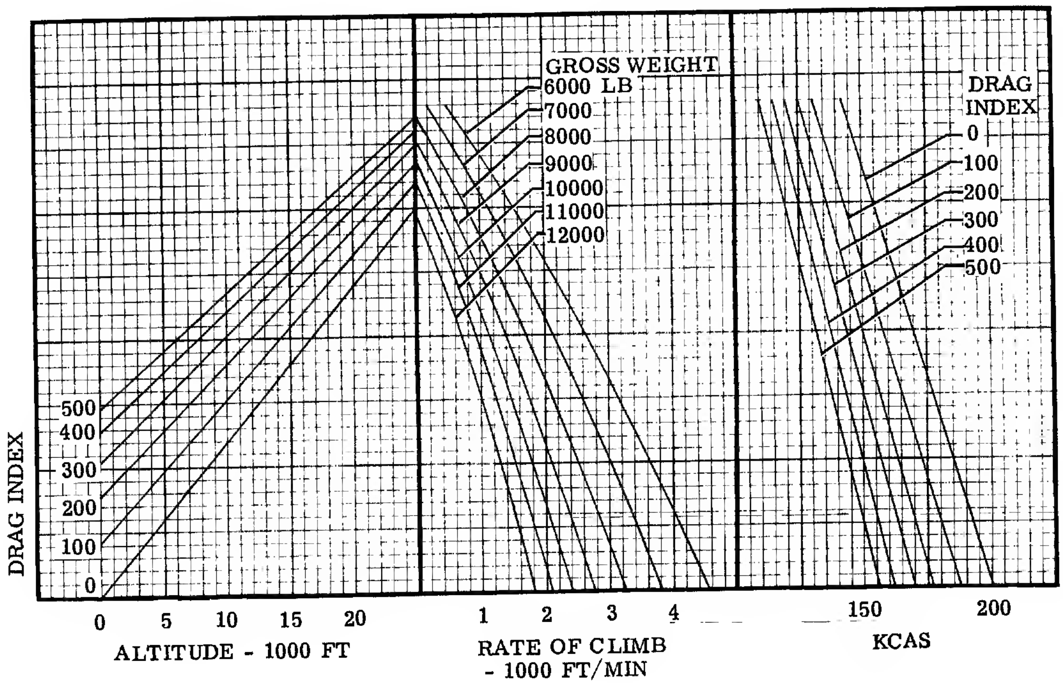


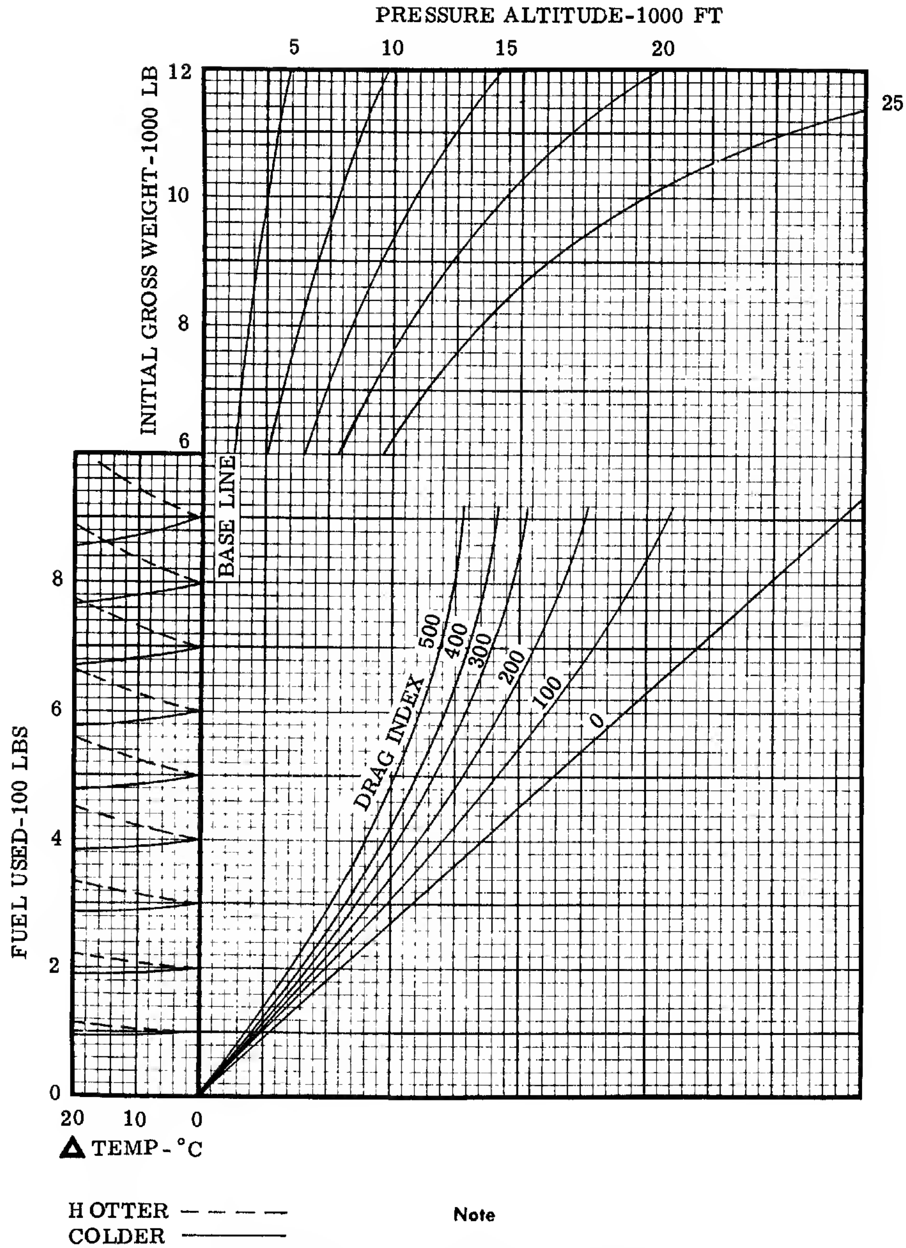
Figure A3-4

FUEL USED TO CLIMB

SINGLE ENGINE
MAXIMUM THRUST

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



Note

Allow 300 pounds fuel for engine start, taxi, takeoff and acceleration to climb speed.

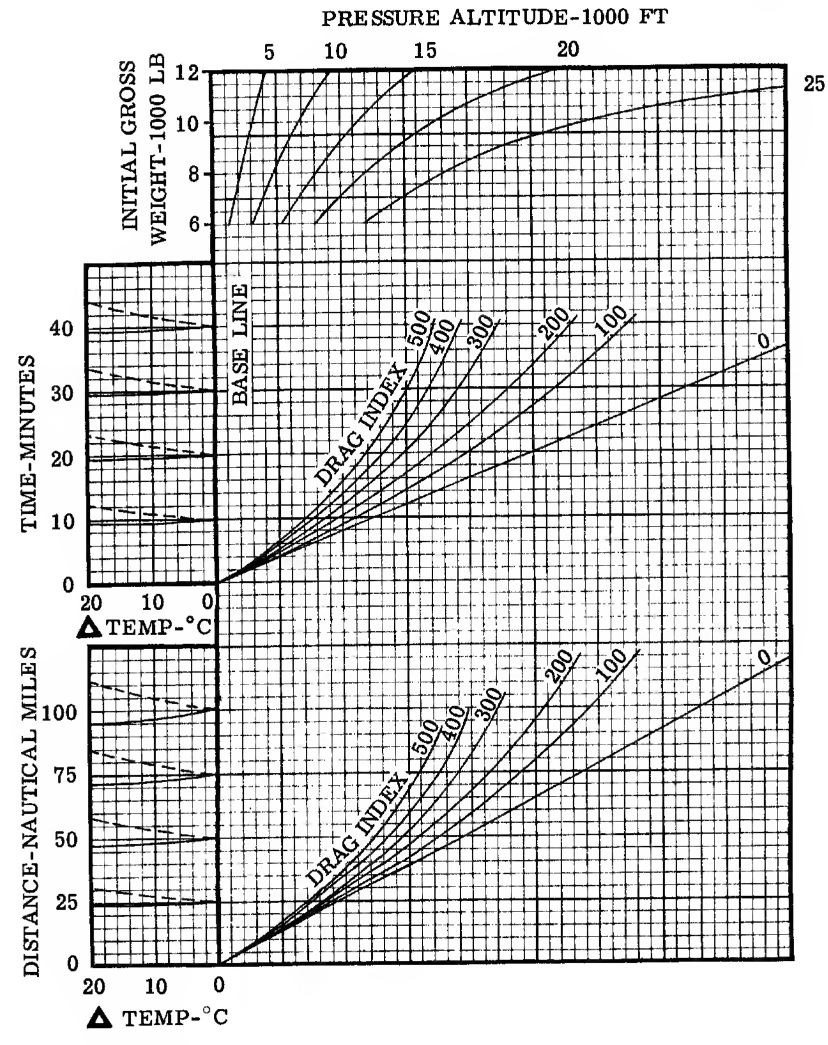
Figure A3-5

TIME TO CLIMB AND HORIZONTAL DISTANCE TRAVELED DURING CLIMB

SINGLE ENGINE
MAXIMUM THRUST

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



Note

Allow 300 pounds fuel for engine start, taxi, takeoff and acceleration to climb speed.

Figure A3-6

PART IV — RANGE

TABLE OF CONTENTS

MACH NUMBER - CALIBRATED AIRSPEED CONVERSION

Using the Mach Number - Calibrated Airspeed Conversion Chart (figure A4-1) the pilot may obtain calibrated airspeed from Mach number or Mach number from calibrated airspeed at any desired altitude. Compressibility has been accounted for in the chart and no further correction is necessary.

EXAMPLE:

Enter chart (figure A4-1)
At altitude = 15,000 feet (A)
Move up to Mach number = .40 (B)
Move horizontally to the left to Calibrated Airspeed scale and read calibrated airspeed = 200 knots (C)

CONSTANT ALTITUDE CRUISE 99% MAXIMUM RANGE

The 99% Maximum Range Charts (figures A4-2 and A4-3) are used to obtain near maximum range for a given quantity of fuel while maintaining speeds higher than those required for peak maximum range. From these charts the pilot can determine: (1) cruise speed, (2) cruise distance for a given fuel quantity or fuel required to fly a given distance, (3) time elapsed during cruise, and (4) wind correction to range.

The calibrated airspeeds given must be used to obtain the distance shown. These charts are based on standard temperature at the indicated altitudes. Although fuel flow and true airspeed vary with atmospheric conditions, these variations are proportional to temperature and the air miles per pound of fuel remains the same at any given calibrated airspeed. Elapsed time given, however, becomes less accurate as temperature deviates from standard.

USE

To find cruise distance and time elapsed, the charts are entered with known values of fuel available for cruise, cruise altitude and winds. To find fuel required for a desired distance or time, an estimated quantity of fuel is used to compute tentative distance and time, which are in turn used to compute a fuel quantity. This process is repeated, if necessary, using computed fuel for the next estimate, until the estimated and computed values approximate each other.

EXAMPLE I:

Conditions:

Initial Gross Weight:	11,000 lb
Cruise Altitude:	20,000 ft
Cruise Fuel	1000 lb
Wind: Average 20 knot tailwind	
Drag Index	100

Find: Cruise Speed, Ground Distance, Time Elapsed.

Solution:

1. Determine Average Gross Weight:
   Initial Gross Weight: 11,000 lb
   Cruise Fuel: 1000 lb
   Final Gross Weight: 11,000-1000 = 10,000 lb
   Average Gross Weight: $\frac{11,000+10,000}{2} = 10,500$ lb

2. Enter figure A4-2:
   At Average Gross Weight = 10,500 lb (A)
   Move horizontally to Altitude = 20,000 ft (B)
   Drop vertically to Fuel Used = 1000 lb (C)
   Move horizontally to Drag Index Line (D), then drop to Distance scale and read Distance = 180 Naut. Mi. (E)

3. Enter figure A4-3:
   At Average Gross Weight = 10,500 lb (F)
   Move horizontally to Altitude = 20,000 ft (G)
   Drop vertically to Drag Index Line = 100 (H), then move to the left to Mach Number scale and Mach Number = .47 (I) (Read Cruise Speed = 212 knots CAS from figure A4-1) Move to the right from (H) to Distance = 180 Naut. Mi. (J)
   Move up to the Time scale and read Time = 36 min (K).
   Continue up to Wind Velocity = 20 knots (L)
   Move to the left to Range Increment scale and read Range Increment = 12 Naut. Mi. (M)
   Since the wind is a tailwind add the Range Increment to the no-wind reading of (E) above:
   Ground Distance = 180 + 12 = 192 Naut. Mi.

CONSTANT ALTITUDE CRUISE 95% RPM

The 95% RPM cruise charts (figures A4-4 and A4-5) represent the maximum cruise speed that can be used with any given set of conditions and should be restricted to flights where time is an important factor. From these charts the pilot can determine: (1) cruise speed, (2) cruise distance for a given fuel quantity or fuel required to fly a given distance, (3)

time elapsed during cruise, and (4) wind correction to range.

These charts are based on standard temperature at the indicated altitudes. Since, at constant RPM, calibrated airspeed, true airspeed and fuel flow vary with atmospheric conditions, these charts become less accurate as temperature deviates from standard.

USE

The 95% RPM Cruise Charts are used in the same manner as the 99% Maximum Range Charts. For sample problems refer to CONSTANT ALTITUDE CRUISE (99% MAXIMUM RANGE).

AIR NAUTICAL MILES PER POUND OF FUEL

These charts (figure A4-10 thru A4-15) provide Cruise control data for various speeds and gross weights from sea level to 25, 000 feet altitude, as well as recommended cruise speeds for obtaining maximum range and for maximum endurance. Also included are data for cruise at 95% RPM, and for reading true airspeed and fuel flow for any conditions or gross weight, altitude, Mach Number, and ambient temperature. Charts for both two engine and single engine operation are included.

The Air Nautical Miles Per Pound of Fuel charts are included to provide the pilot with a means of planning flight whenever the standard Constant Altitude Cruise charts (figures A4-2 thru A4-5) cannot be used. This would be if: (1) it is desired to cruise at speed other than those given in the Constant Altitude Cruise charts or, (2) atmospheric conditions differ appreciably from standard.

It should be emphasized that the air miles per pound of fuel will remain constant at the Mach Number and calibrated airspeed shown in the charts, regardless of th' prevailing temperature, although the % RPM required, true airspeed and fuel flow will vary with atmospheric conditions. It is then recommended that, when planning a mission with the air nautical miles per pound of fuel charts, calibrated airspeed be used as the cruise control for obtaining the desired range.

USE

Air nautical miles per pound of fuel, true airspeed, and fuel flow are found directly by entering the charts with gross weight, cruise altitude, Mach number and temperature. To find fuel required to cruise a given distance or length of time, an estimated average gross weight for the cruise segment is used, and fuel required determined from the resulting fuel flow and elapsed time. If this value of fuel required results in an average gross weight appreciably different from the estimated weight, the computation is then reworked using the new gross weight.

It should be noted that the line labeled "Maximum Range" is also the base line for the family of guide lines in this portion of the chart. This base line is always intercepted first before proceeding parallel to the guide lines to the desired cruise Mach number. (See Example, steps 3. A thru 3. D.)

EXAMPLE:

Conditions:

Initial Gross Weight:	11, 000 lb
Cruise Altitude:	15, 000 ft
Temperature:	-20°C
Wind: Average 60 knots headwind	

Find: Cruise speed for maximum range and fuel required to fly 200 Naut. Mi.

Solution:

1. Estimate Fuel Used: 1500 lb

2. Determine Estimated Average Gross Weight:
   Initial Gross Weight: 11, 000 lb
   Estimated Fuel Used: 1500 lb
   Estimated Final Weight: 11, 000-1500 = 9500 lb
   Estimated Average Gross Weight: $\frac{11,000+9500}{2} = 10,250$ lb

3. Enter figure A4-10 (Sheet 1 of 2):
   At Gross Weight = 10250 lb (A)
   Move up to Cruise Altitude = 15, 000 ft (B)
   Move across horizontally to Base Line (C)
   Move parallel to Guide Lines to 60 knots Headwind (D) (Use linear interpolation between Base Line and Recommended Cruise-100 knots Headwind line)
   Move horizontally to Transfer scale and read Transfer scale = 9. 45 (E)
   Enter Figure A4-10 (Sheet 2 of 2):
   At Transfer scale - 9. 45 (E)
   Move to Altitude = 15, 000 ft (F)
   Drop vertically to Naut. Mi/Lb scale and read Naut. Mi/Lb = . 167 (G)
   Construct vertical line (GH)
   Return to figure A4-10 (Sheet 1 of 2):
   Drop vertically from (D) to Mach Number scale and read Mach Number - . 47 (I)
   (Read Cruise Speed = 235 knots CAS from figure A4-1)
   Continue down to Temperature = -20°C (J)
   Move horizontally to True Airspeed scale and read True Airspeed = 290 knots (K)
   Enter figure A4-10 (Sheet 2 of 2):
   At true Airspeed = 290 knots (K)
   Construct horizontal line (KL)
   At the intersection of constructed lines (GH) and (KL) read Fuel Flow = 1750 lb/hr

4. Compute Ground Speed:
   Ground Speed = TAS - Headwind = 290 - 60 = 230 knots
   Compute Time to fly 200 Naut. Mi.
   Time = Distance ÷ Ground Speed = 200 Naut. Mi. ÷ 230 Naut. Mi/Hr = . 870 hr
   Fuel Used = Fuel Flow x Time = 1750 lb/hr x . 870 hr = 1522 lb

5. Revise Estimated Average Gross Weight:

Initial Gross Weight:	11, 000 lb
Computed Fuel Used:	1471 lb
Final Gross Weight:	11, 000-1522 = 9478 lb
Average Gross Weight:	$\frac{11,000+9478}{2}$ = 10, 239 lb

6. Entering the chart at 10, 239 lb Gross Weight, it is evident that this would result in essentially the same solutions as above, therefore, the problem is not reworked.

MACH NUMBER - CALIBRATED AIRSPEED CHART

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

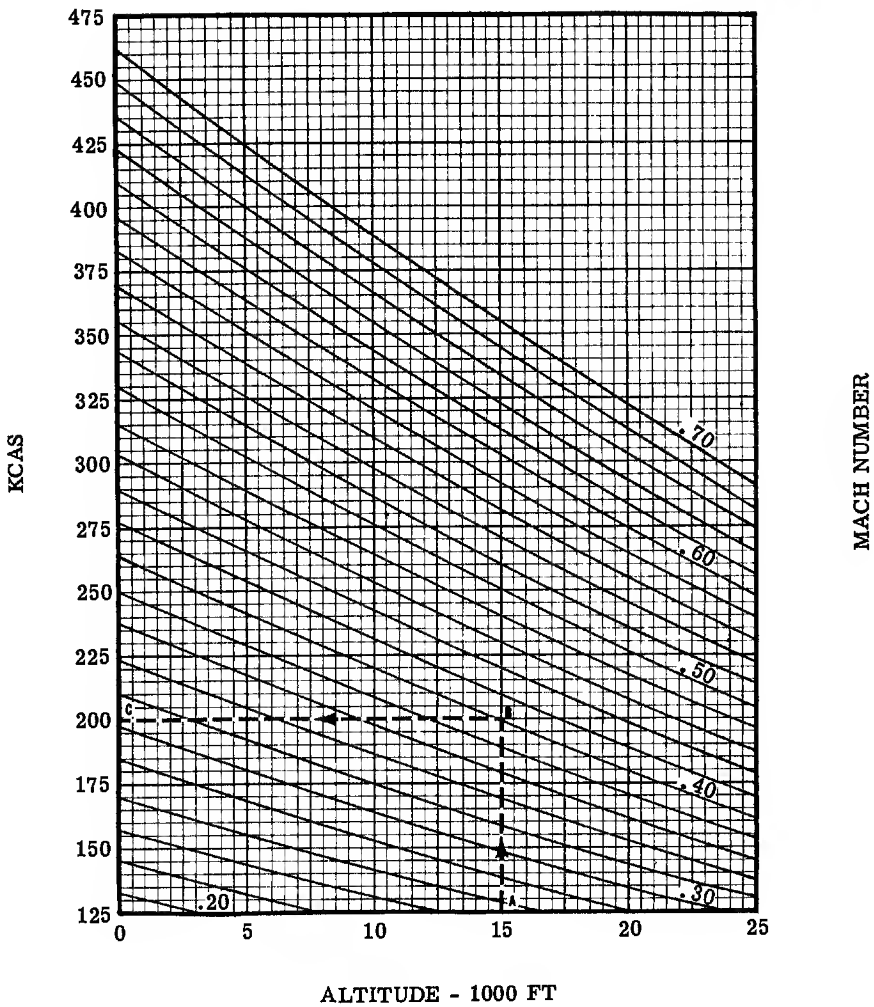


Figure A4-1

CONSTANT ALTITUDE CRUISE DISTANCE

99% MAXIMUM RANGE
TWO ENGINES

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

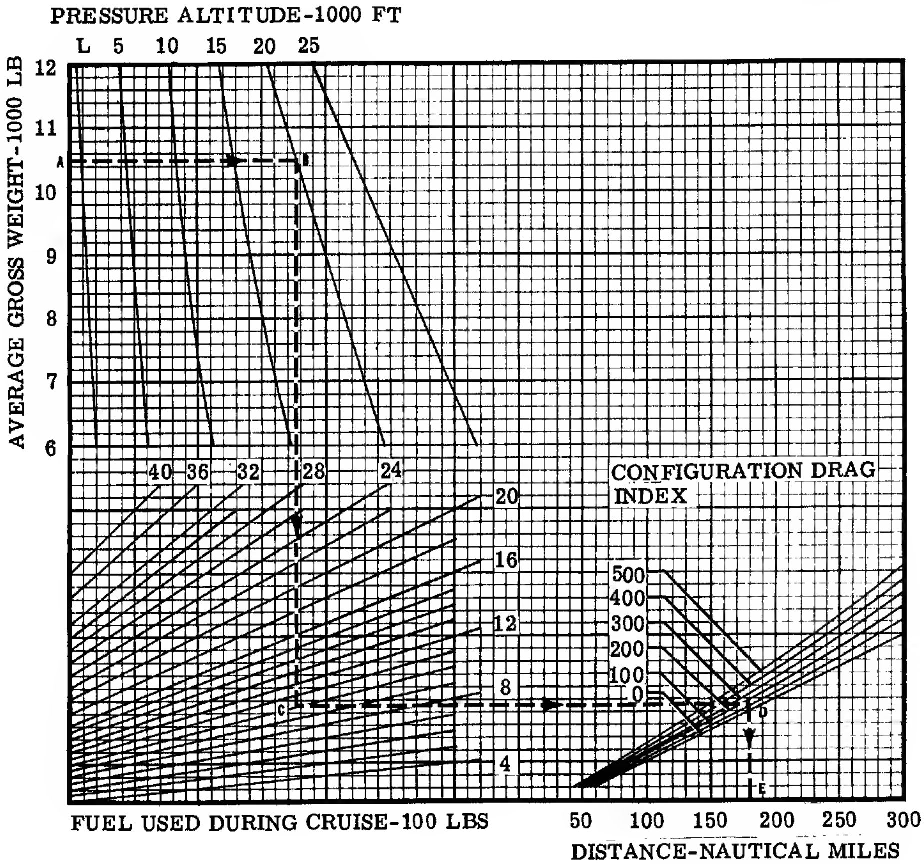


Figure A4-2

CONSTANT ALTITUDE CRUISE - MACH NUMBER AND TIME

99% MAXIMUM RANGE TWO ENGINES

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

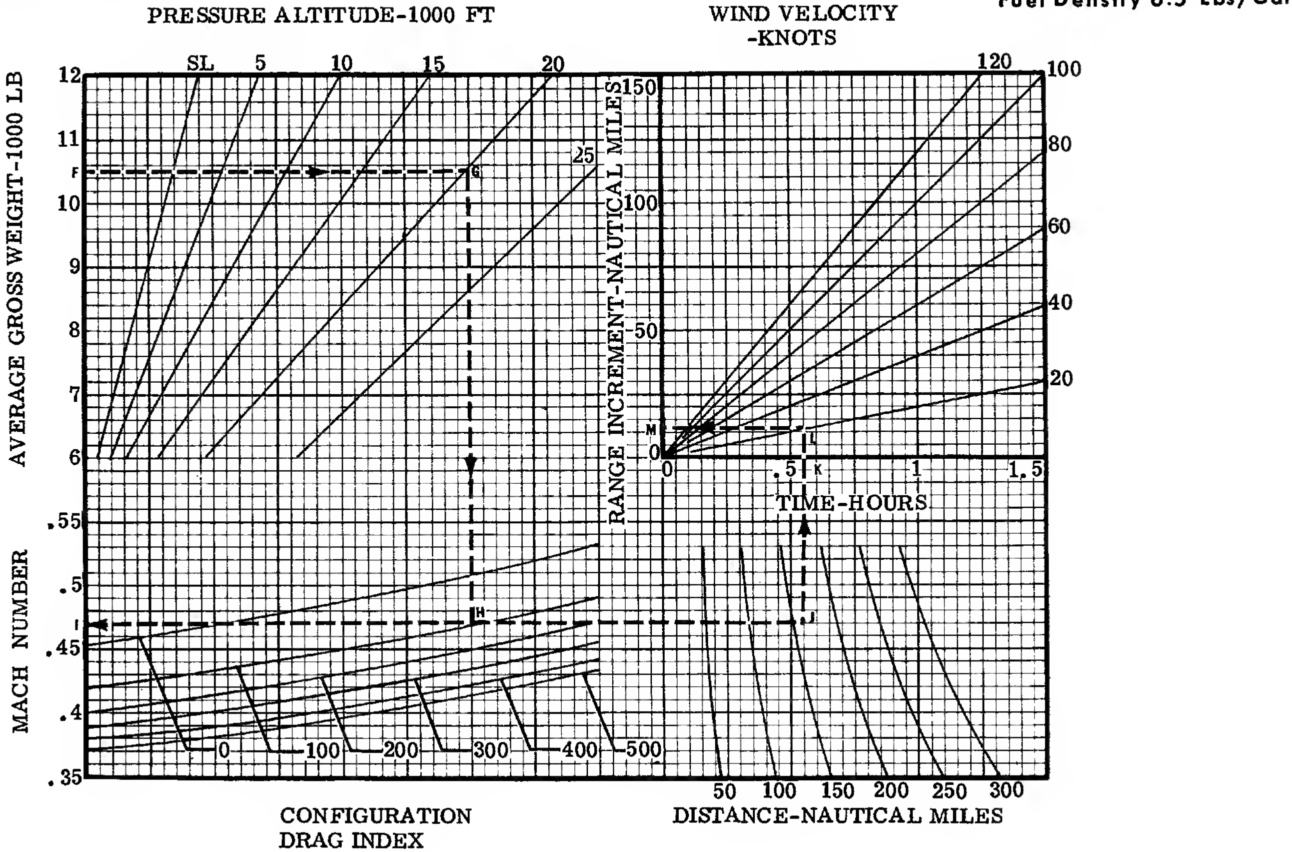


Figure A4-3

CONSTANT ALTITUDE CRUISE DISTANCE

95% RPM
TWO ENGINES

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

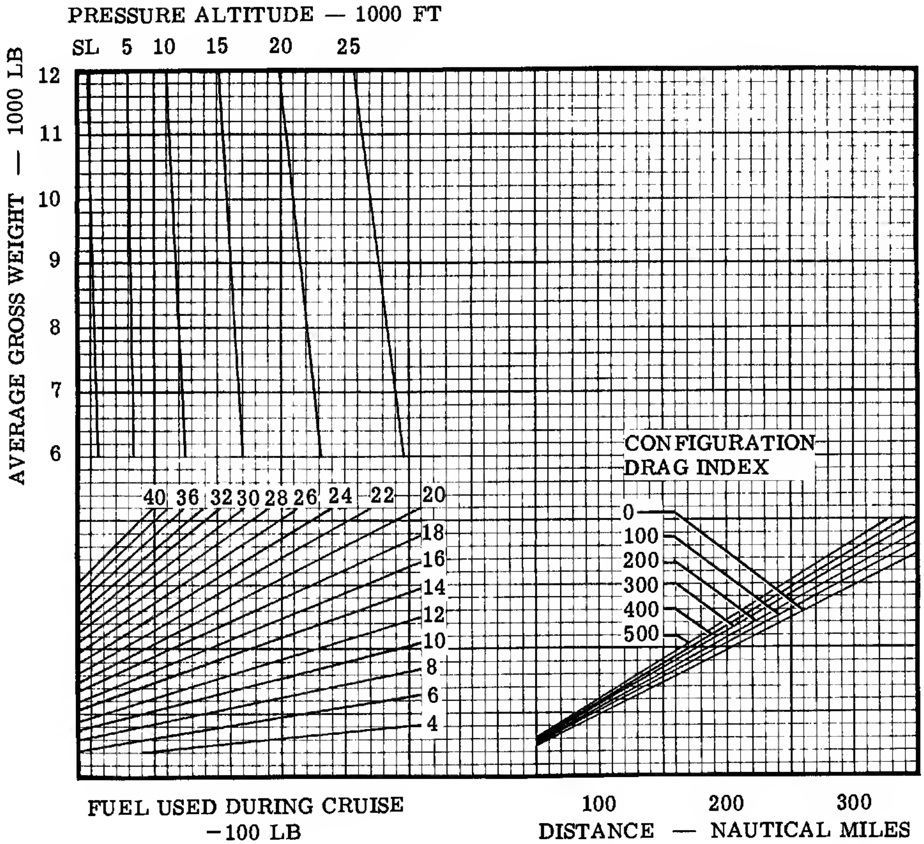


Figure A4-4

CONSTANT ALTITUDE CRUISE-MACH NUMBER AND TIME

95% RPM
TWO ENGINES

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

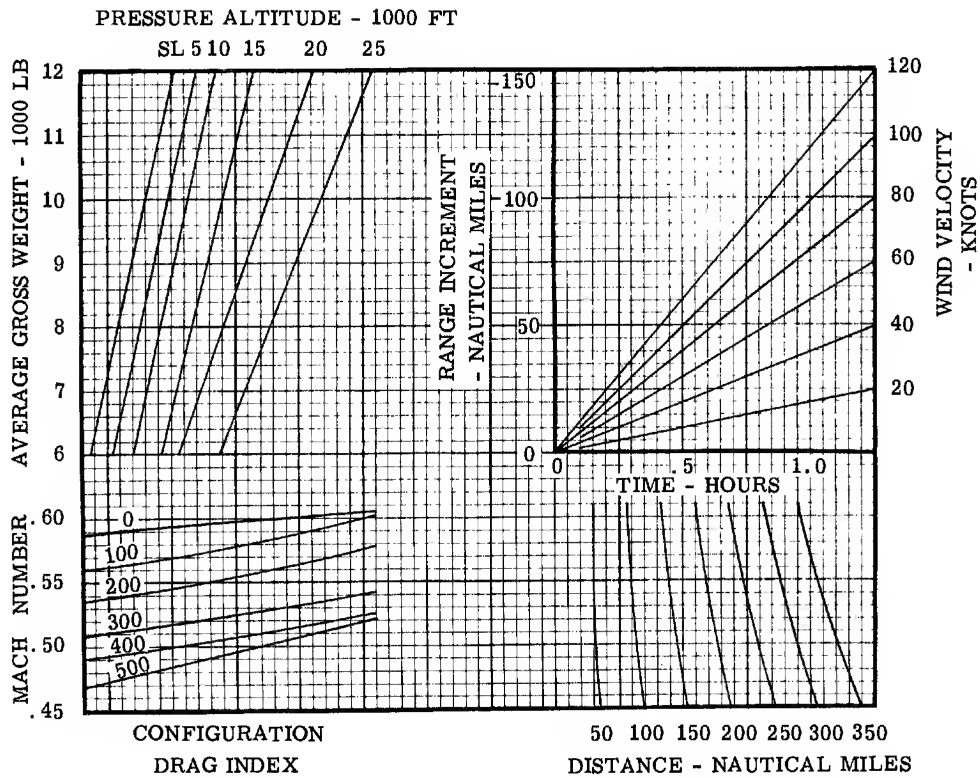


Figure A4-5

CONSTANT ALTITUDE CRUISE DISTANCE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

99% MAXIMUM RANGE
SINGLE ENGINE

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

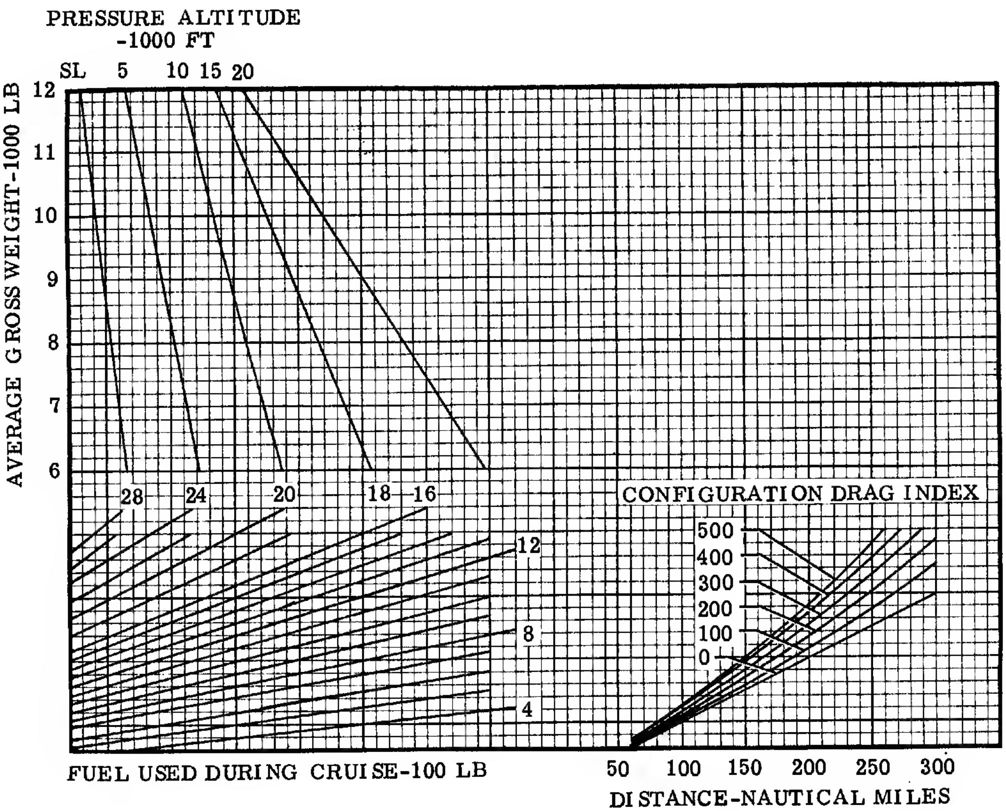


Figure A4-6

CONSTANT ALTITUDE CRUISE - MACH NUMBER AND TIME

99% MAXIMUM RANGE SINGLE ENGINE

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

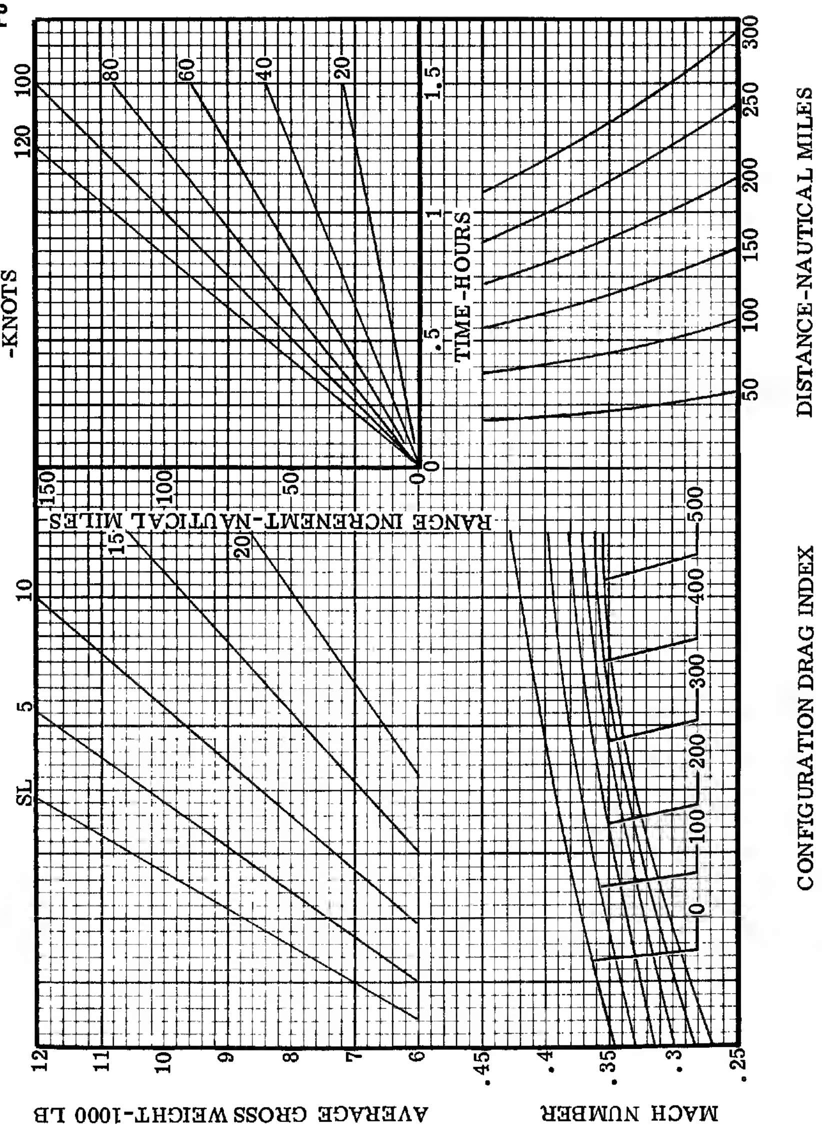


Figure A4-7

CONSTANT ALTITUDE CRUISE DISTANCE

95% RPM
SINGLE ENGINE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

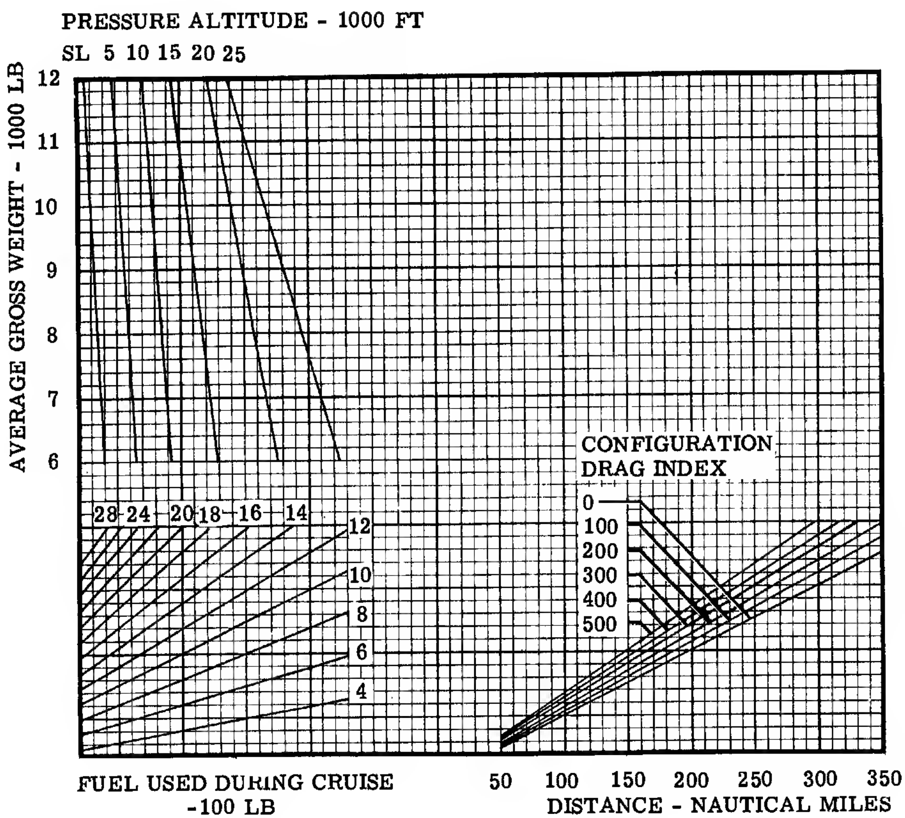


Figure A4-8

CONSTANT ALTITUDE CRUISE-MACH NUMBER AND TIME

95% RPM
SINGLE ENGINE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

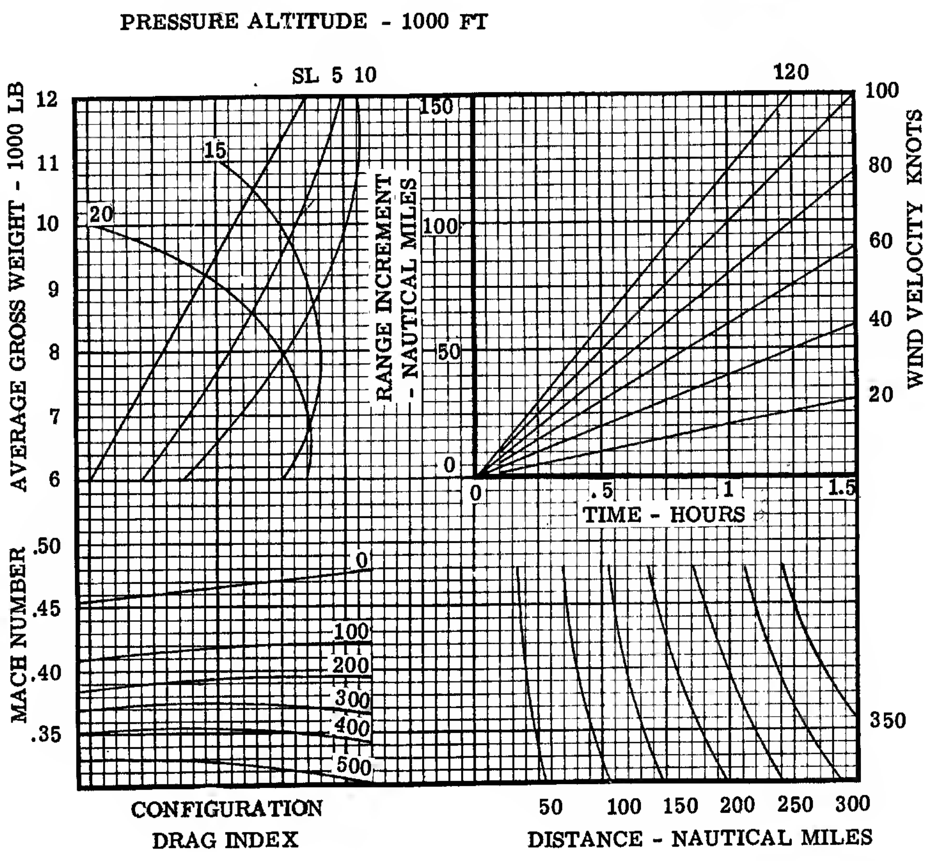


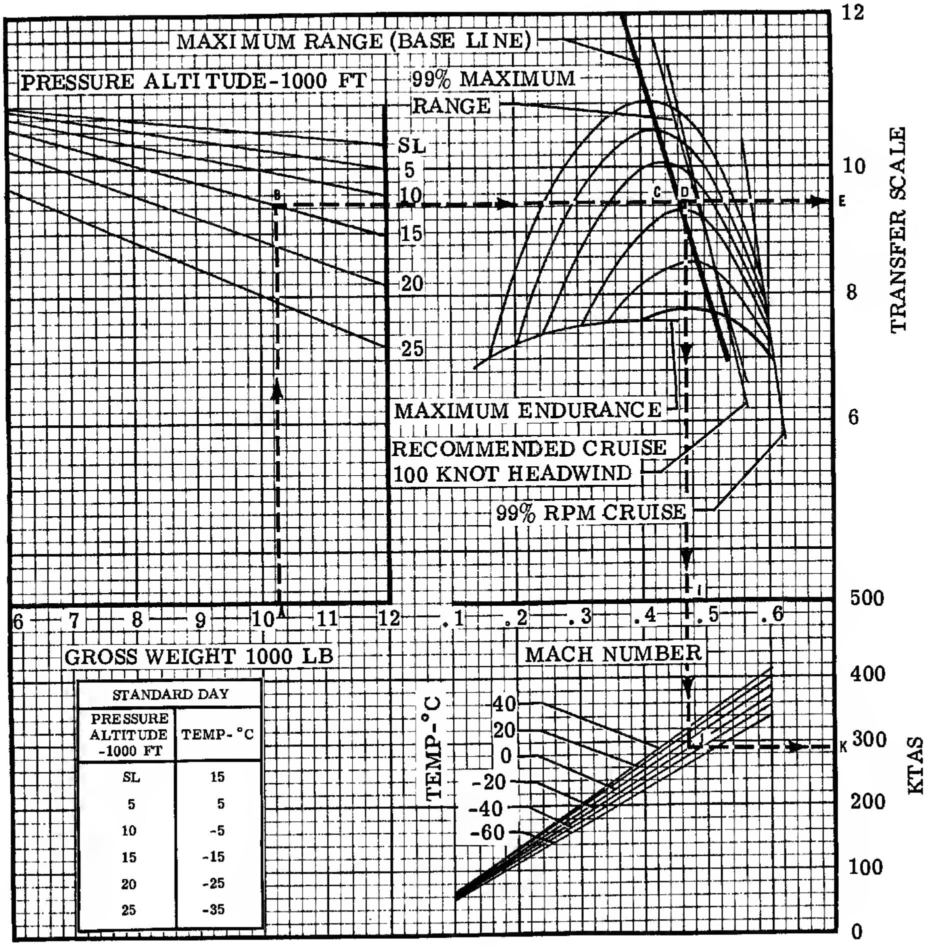
Figure A4-9

AIR NAUTICAL MILES PER POUND OF FUEL

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

TWO ENGINES
DRAG INDEX 0

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP-°C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-10 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

TWO ENGINES

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

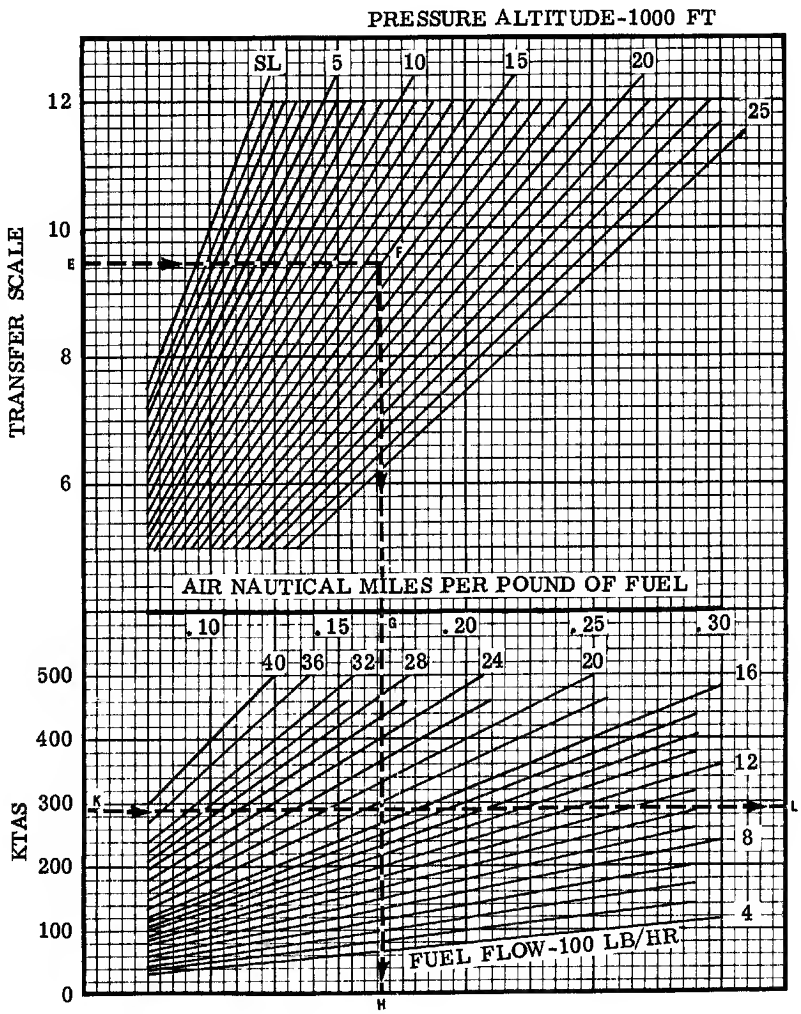


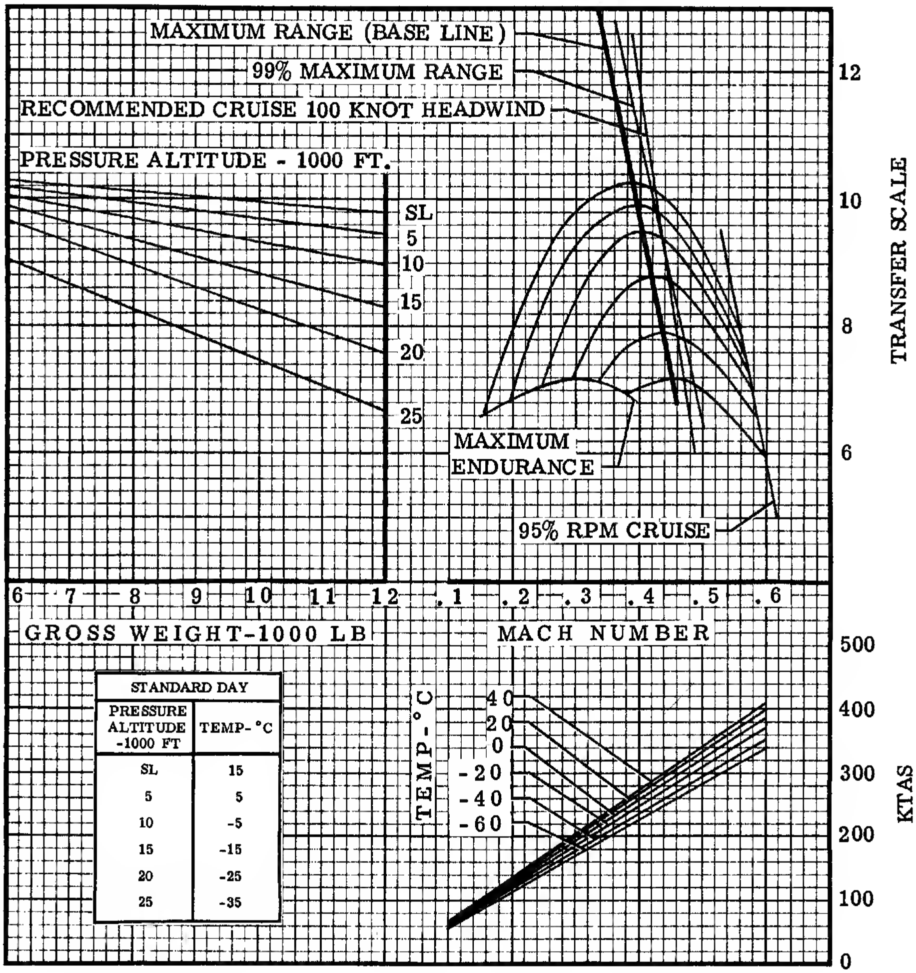
Figure A4-10 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

TWO ENGINES
DRAG INDEX 100

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP- °C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-11 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

TWO ENGINES

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

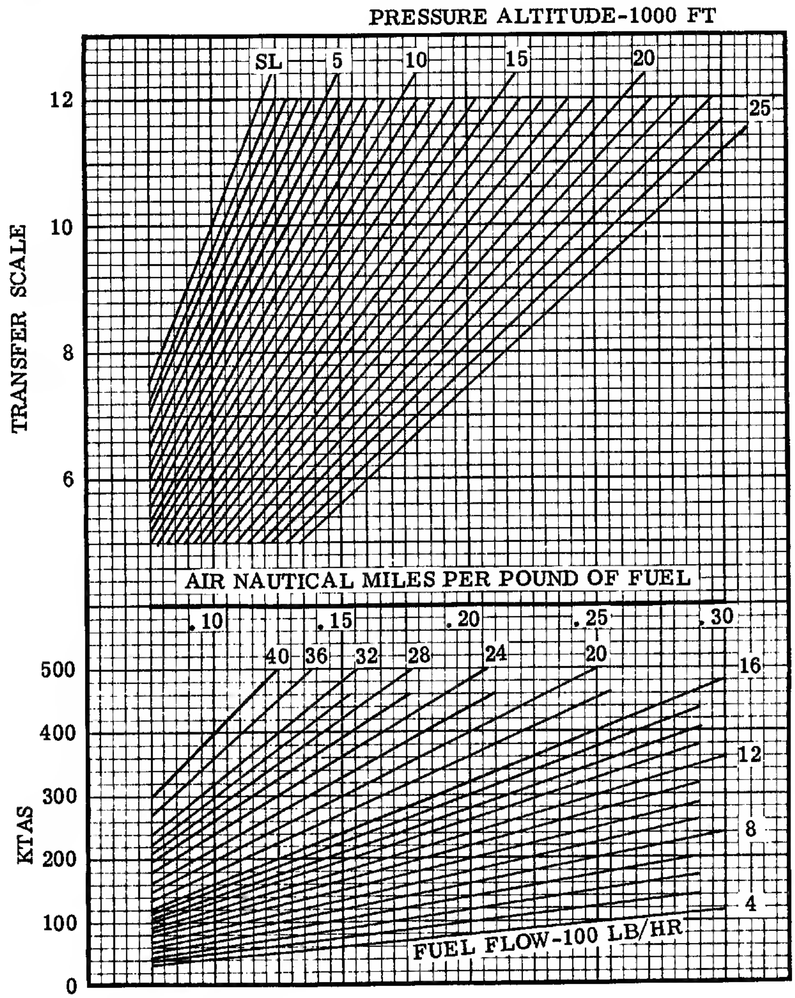


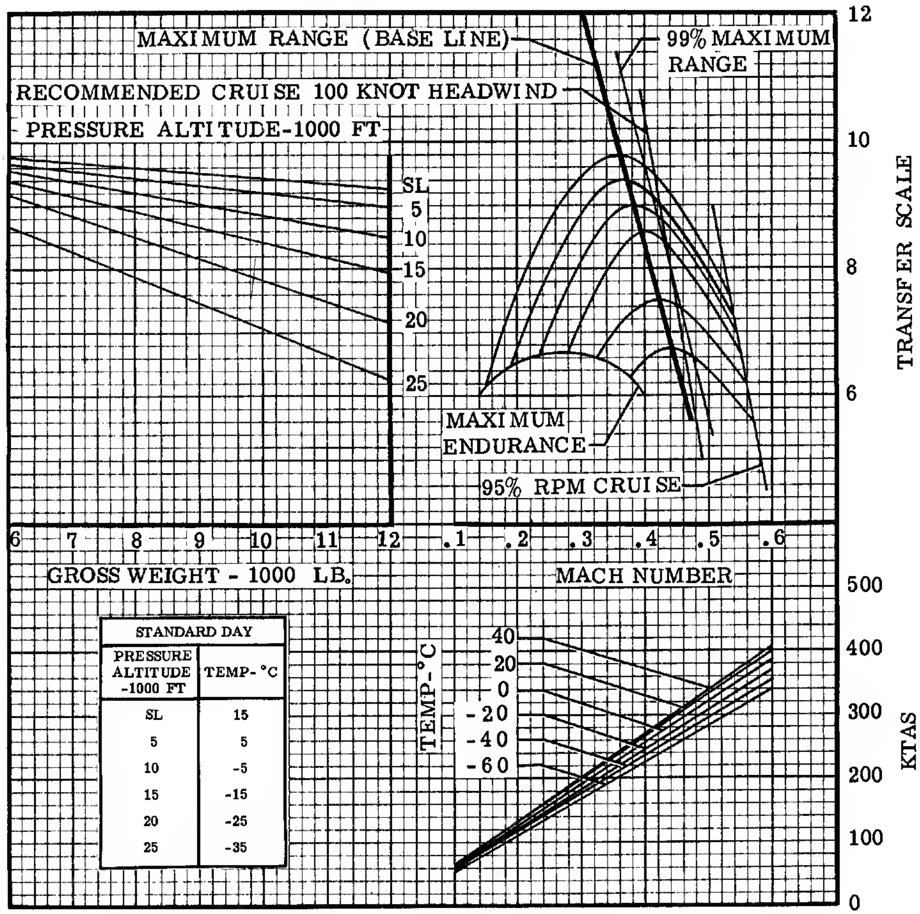
Figure A4-11 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

TWO ENGINES
DRAG INDEX 200

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP- °C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-12 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

TWO ENGINES

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

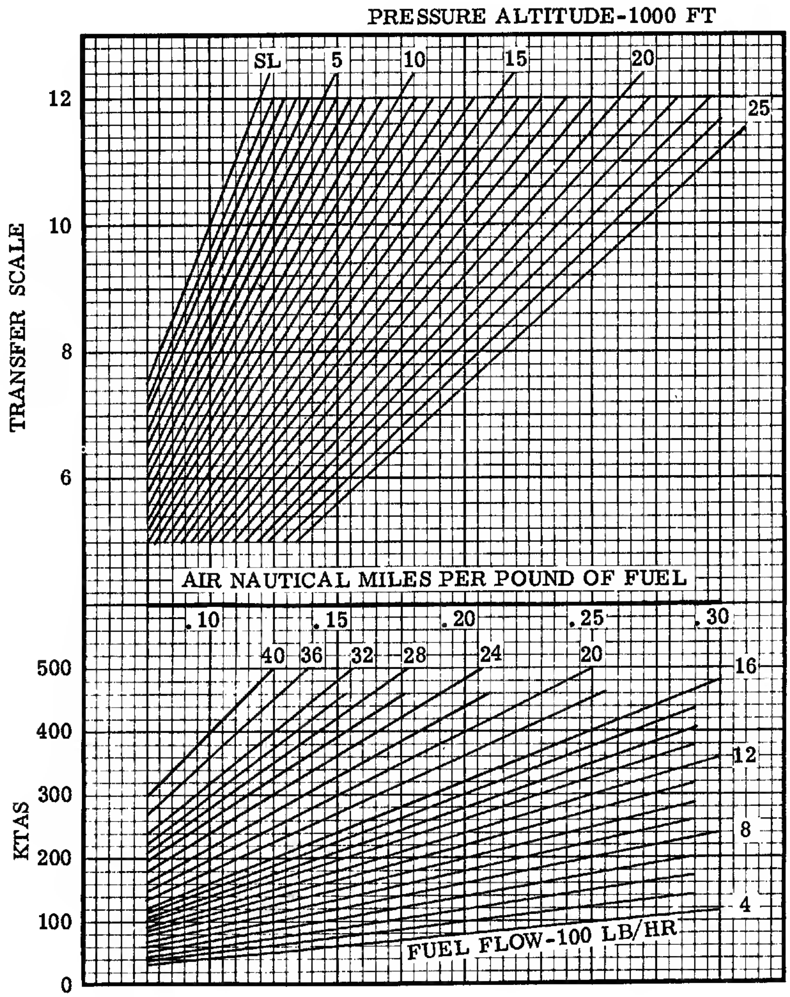


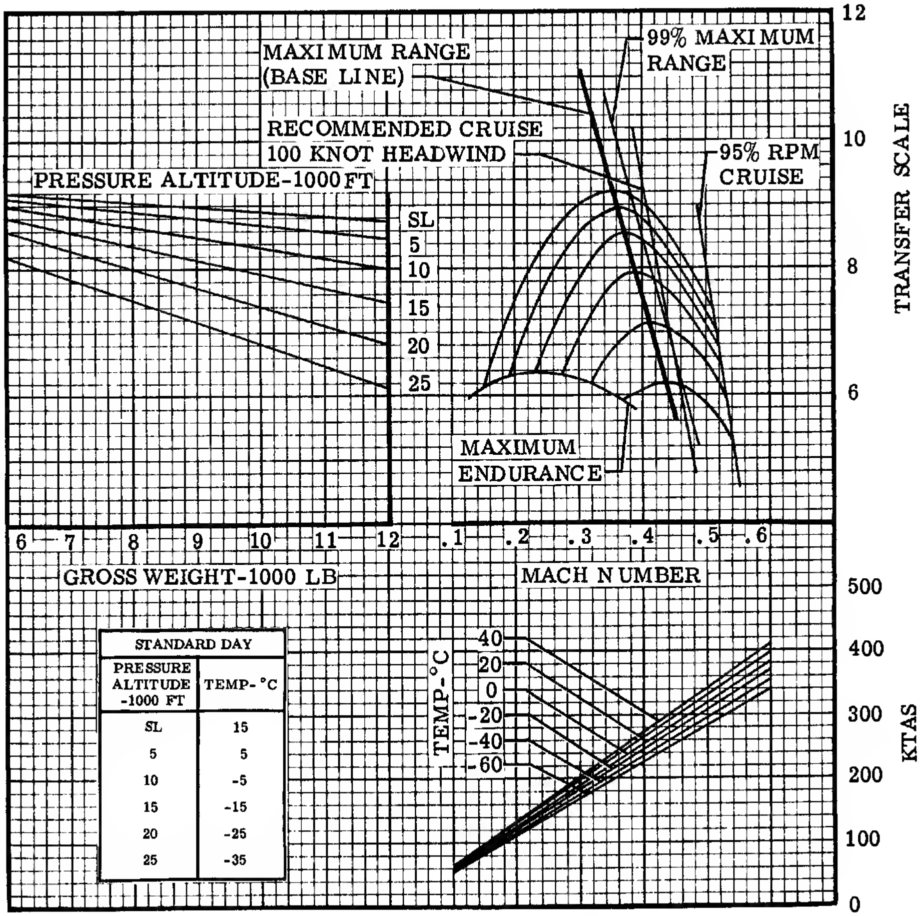
Figure A4-12 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

TWO ENGINES
DRAG INDEX 300

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP-°C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-13 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

TWO ENGINES

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

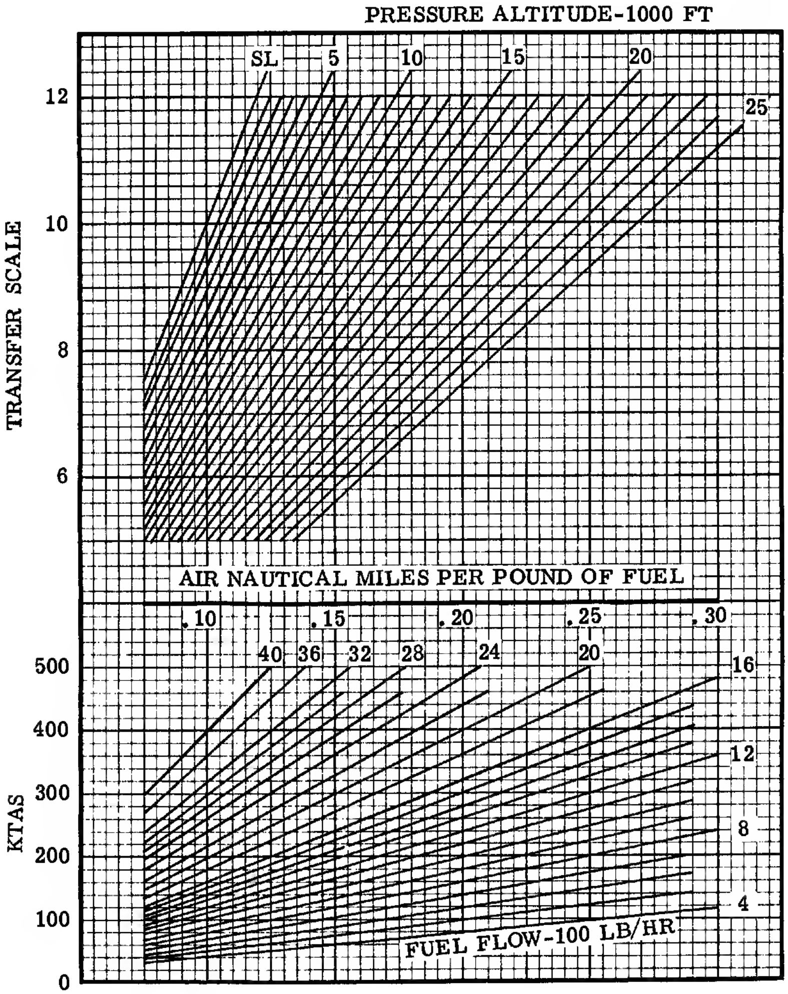


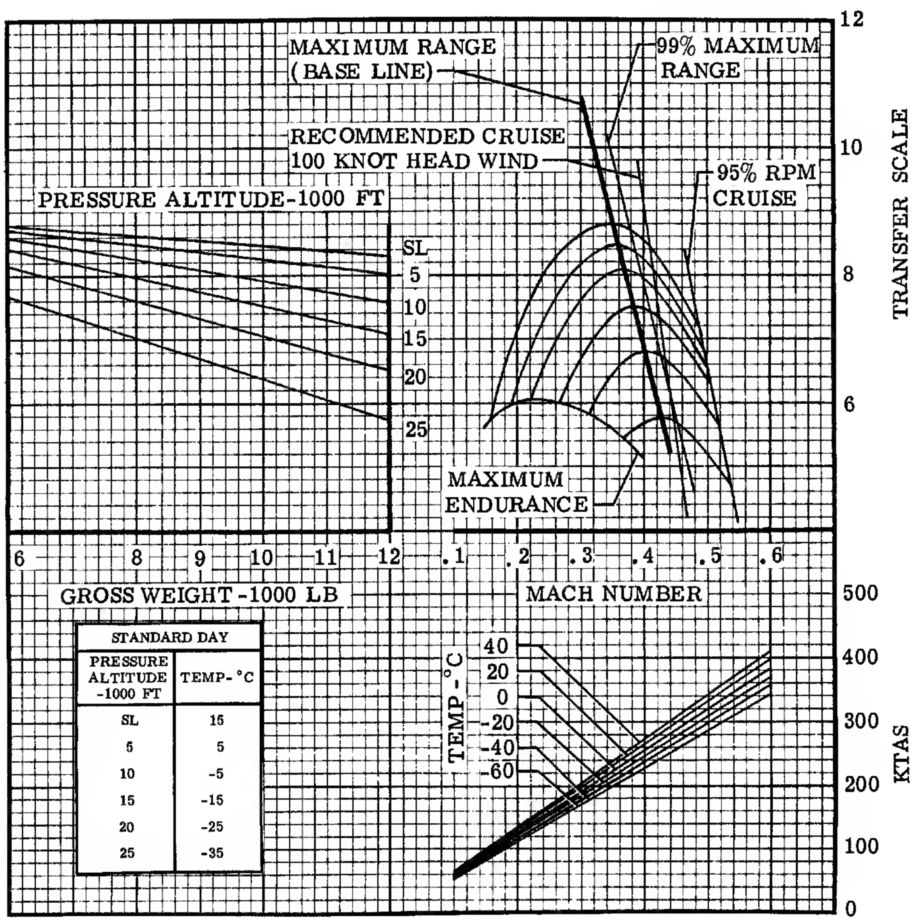
Figure A4-13 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

TWO ENGINES
DRAG INDEX 400

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP- °C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-14 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

TWO ENGINES

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

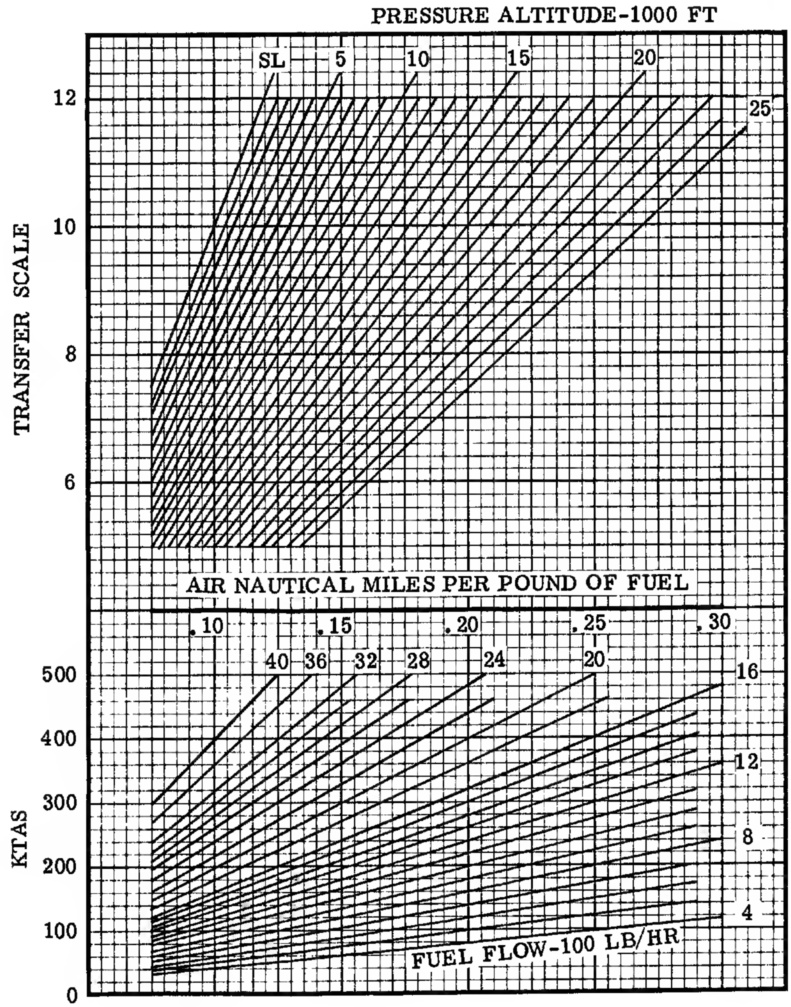


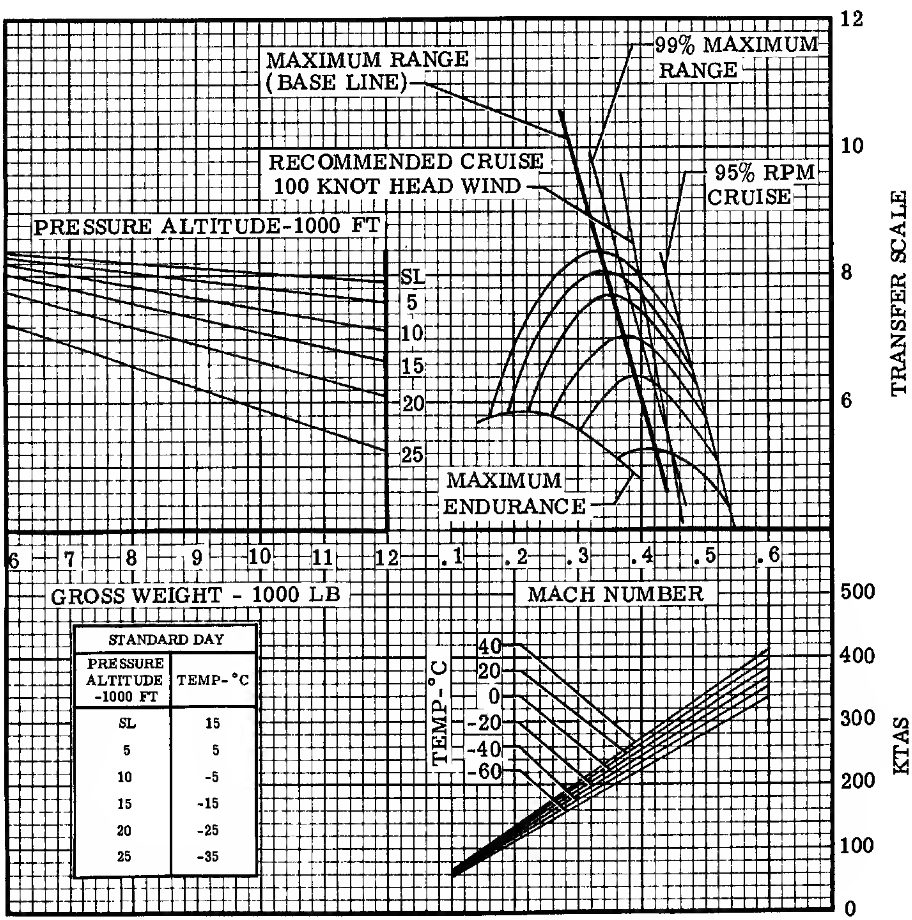
Figure A4-14 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

TWO ENGINES
DRAG INDEX 500

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP-°C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-15 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

TWO ENGINES

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

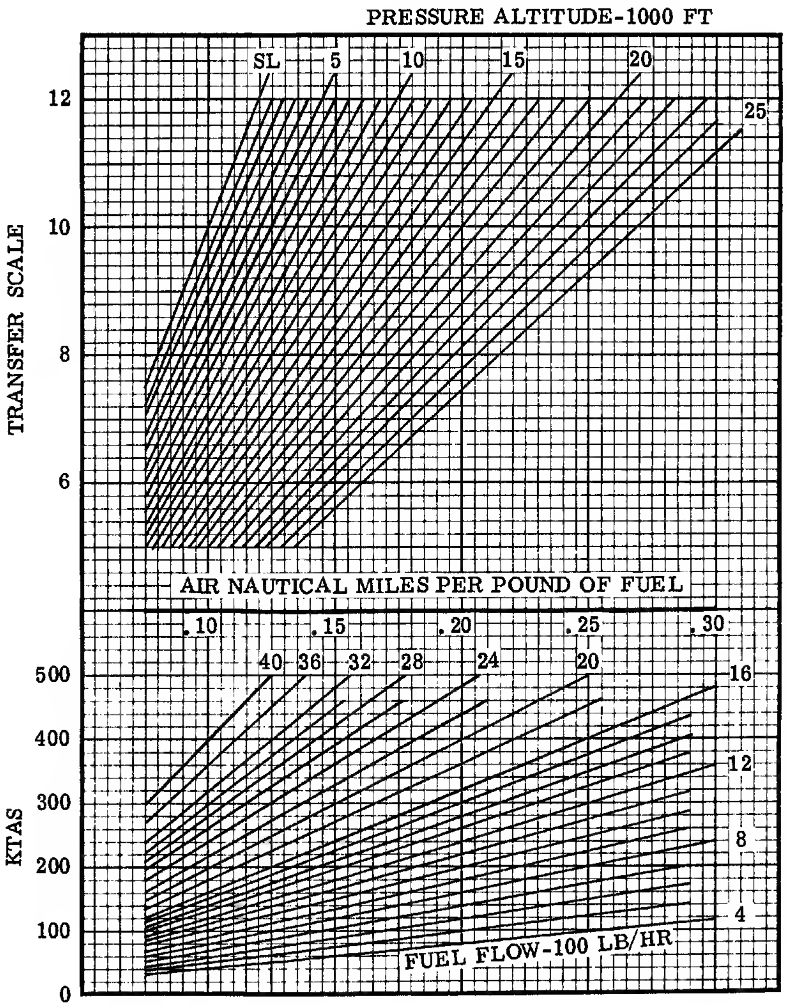


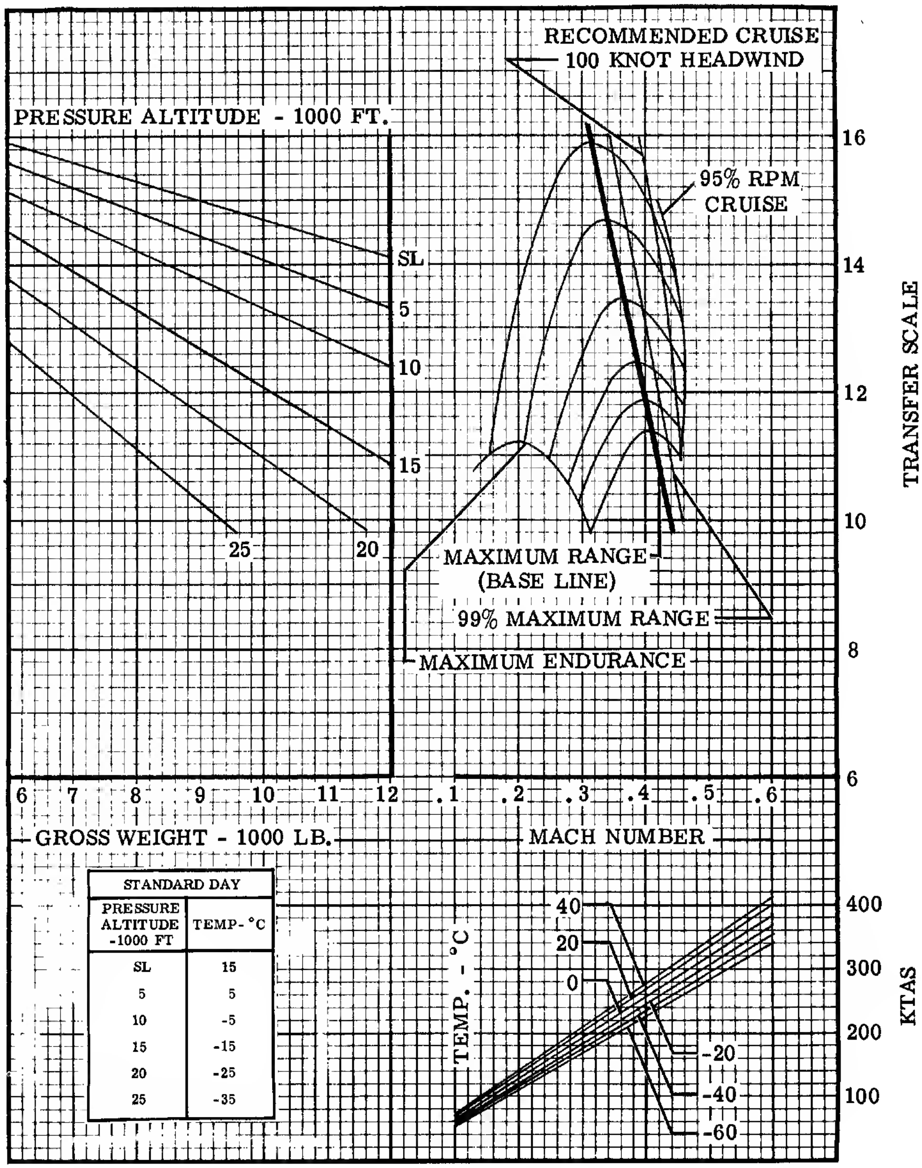
Figure A4-15 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE
DRAG INDEX 0

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP- °C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-16 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

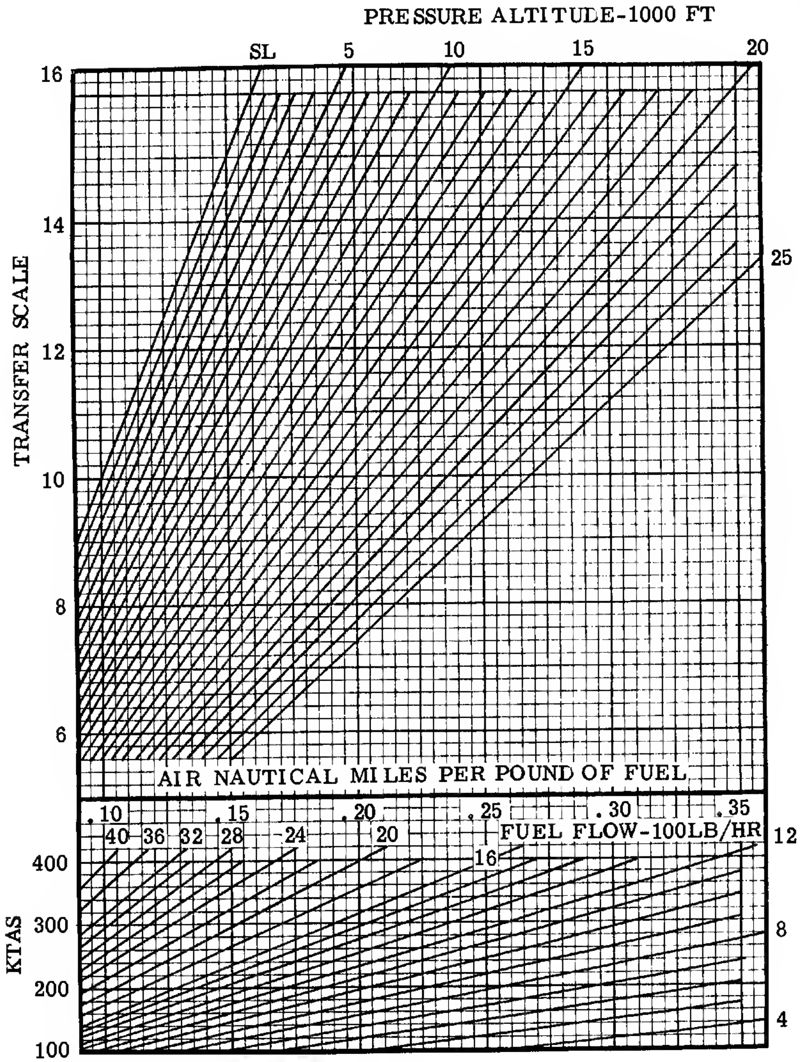


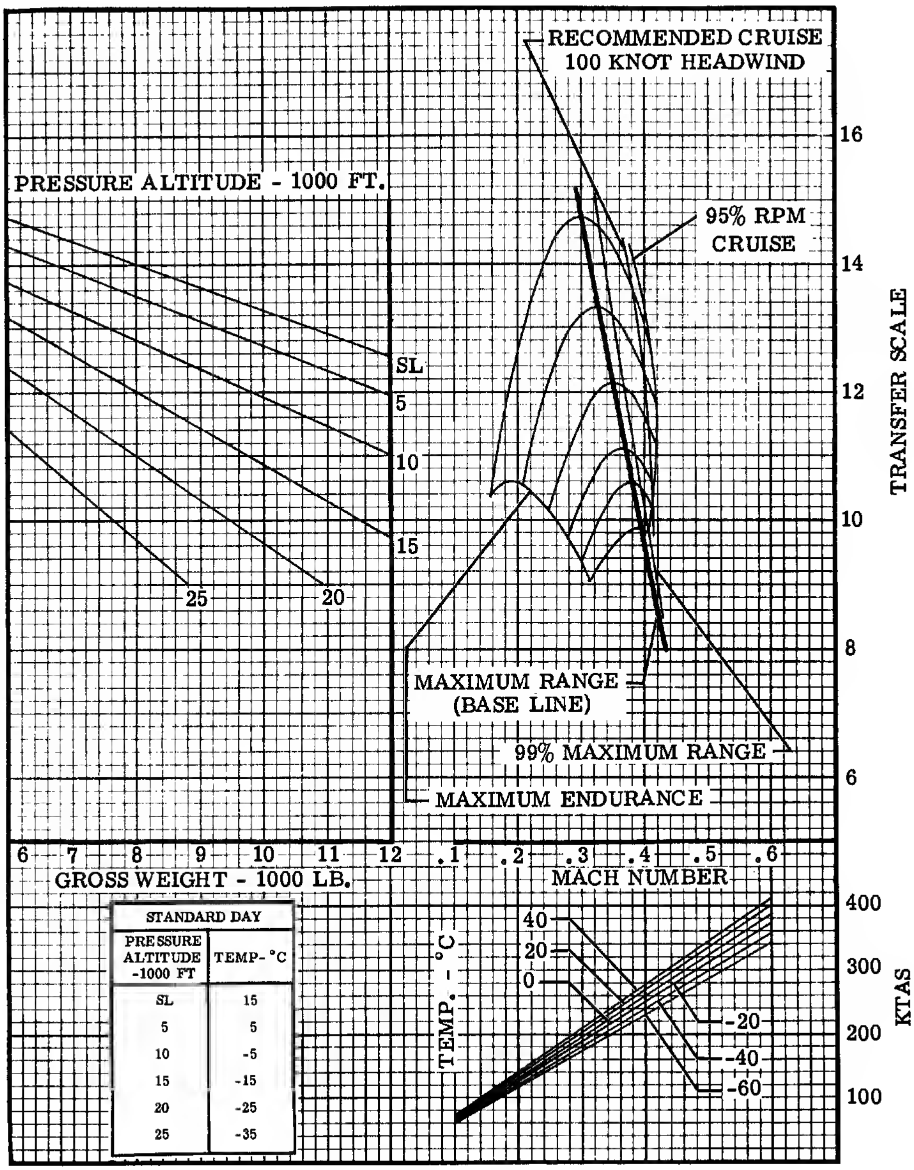
Figure A4-16 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE
DRAG INDEX 100

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP- °C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-17 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

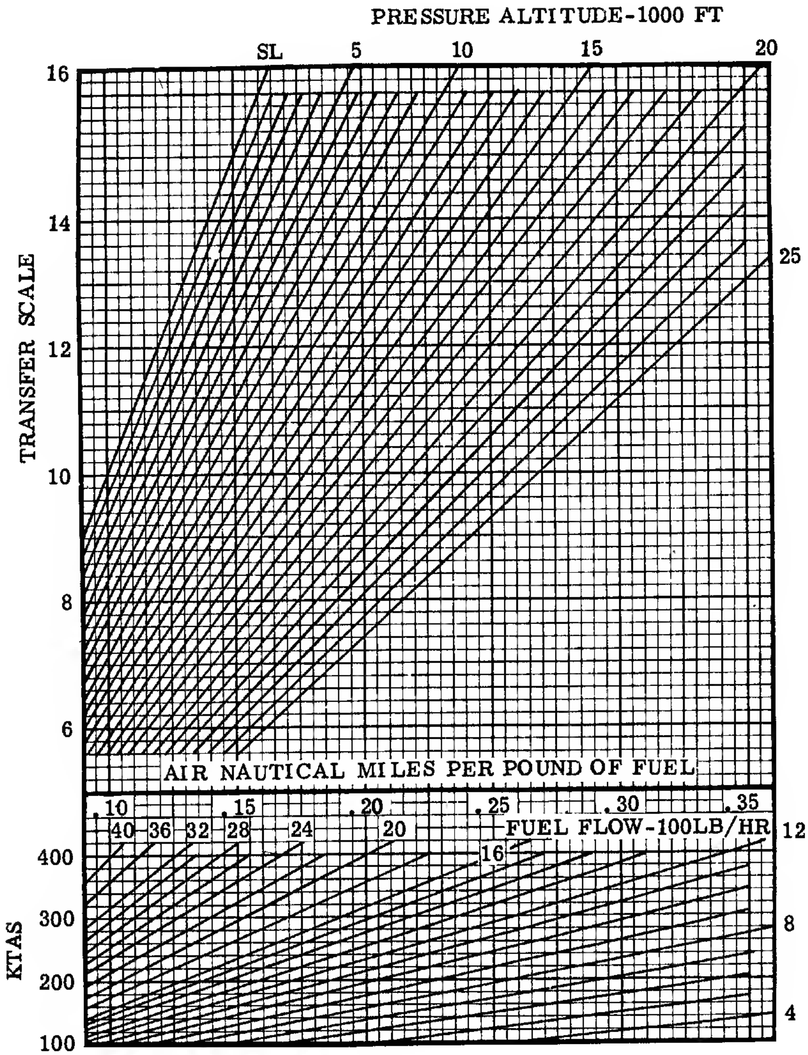


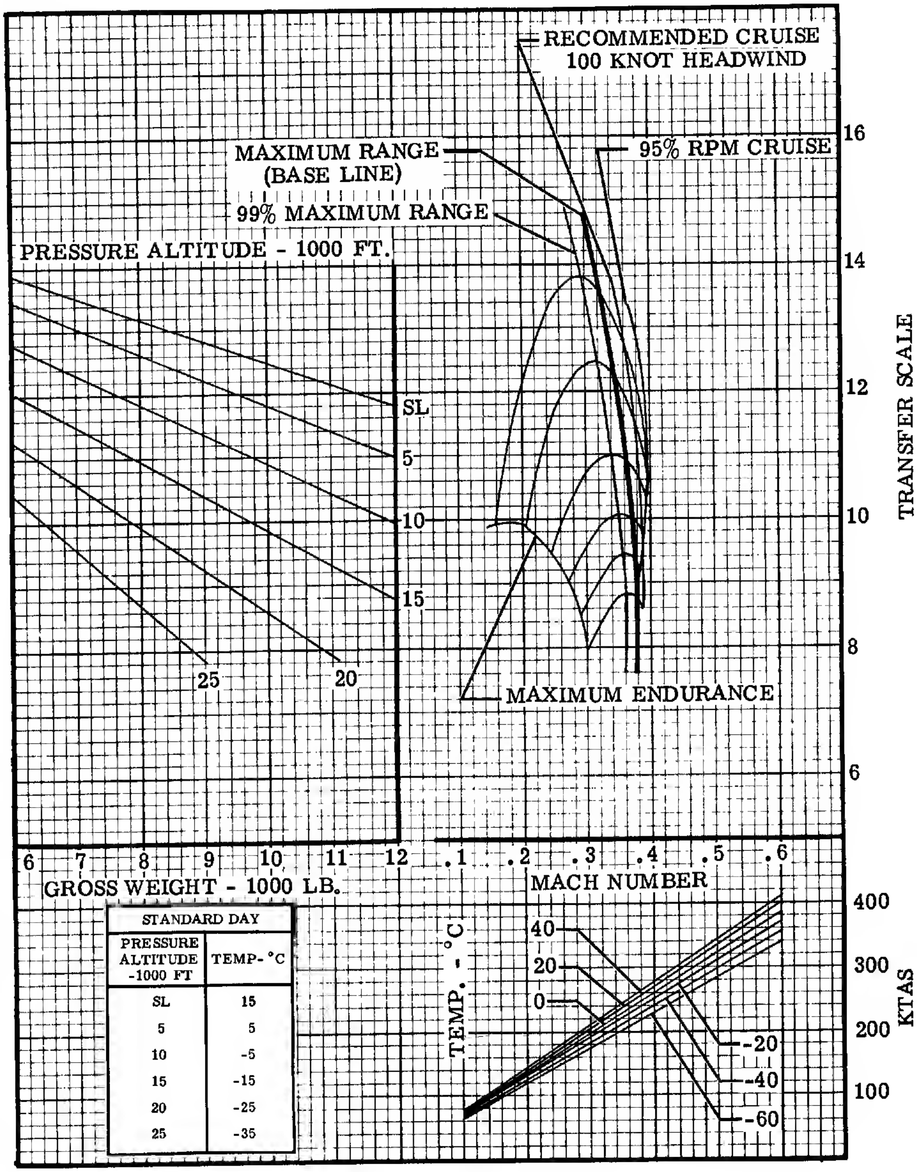
Figure A4-17 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE
DRAG INDEX 200

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP- °C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-18 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

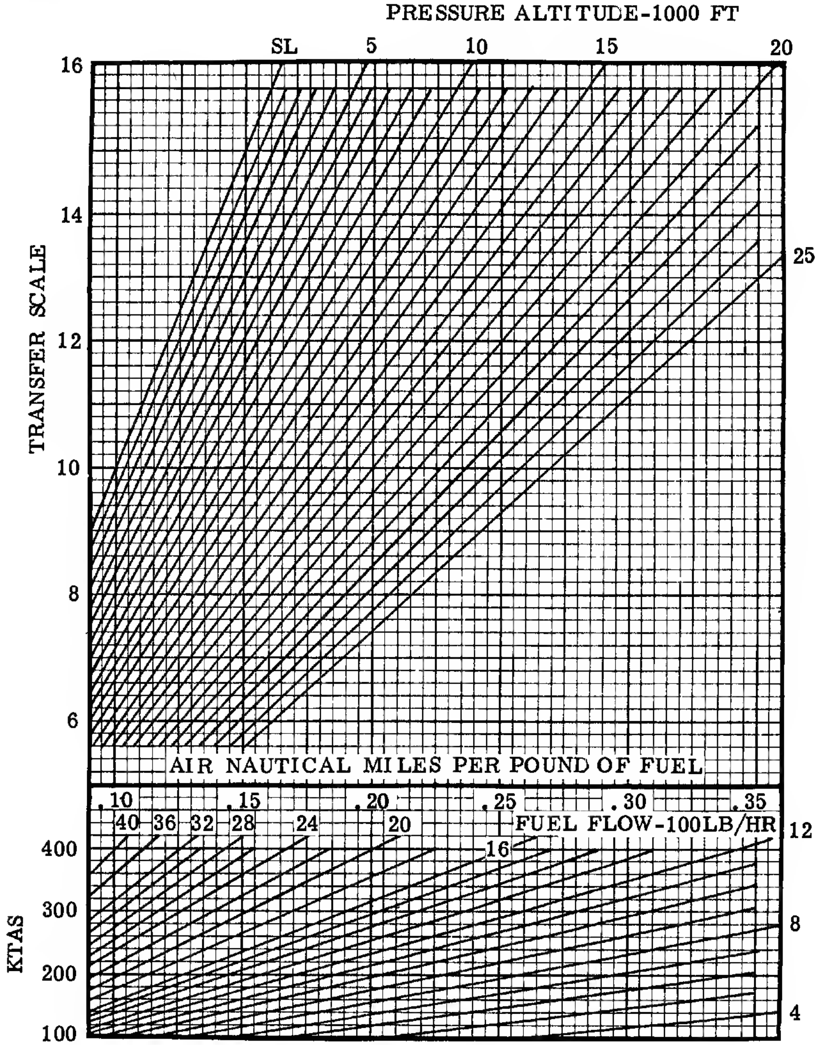


Figure A4-18 (Sheet 2 of 2)

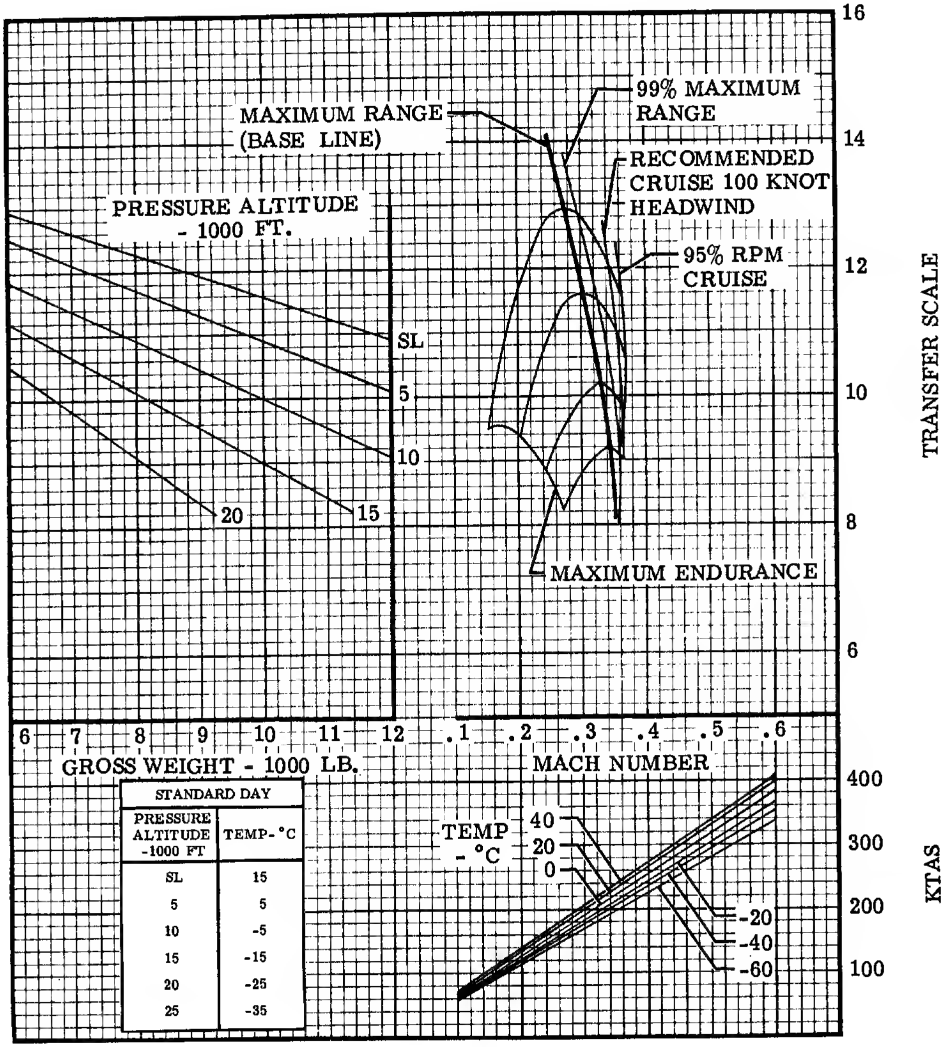
AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE

DRAG INDEX 300

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP-°C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-19 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

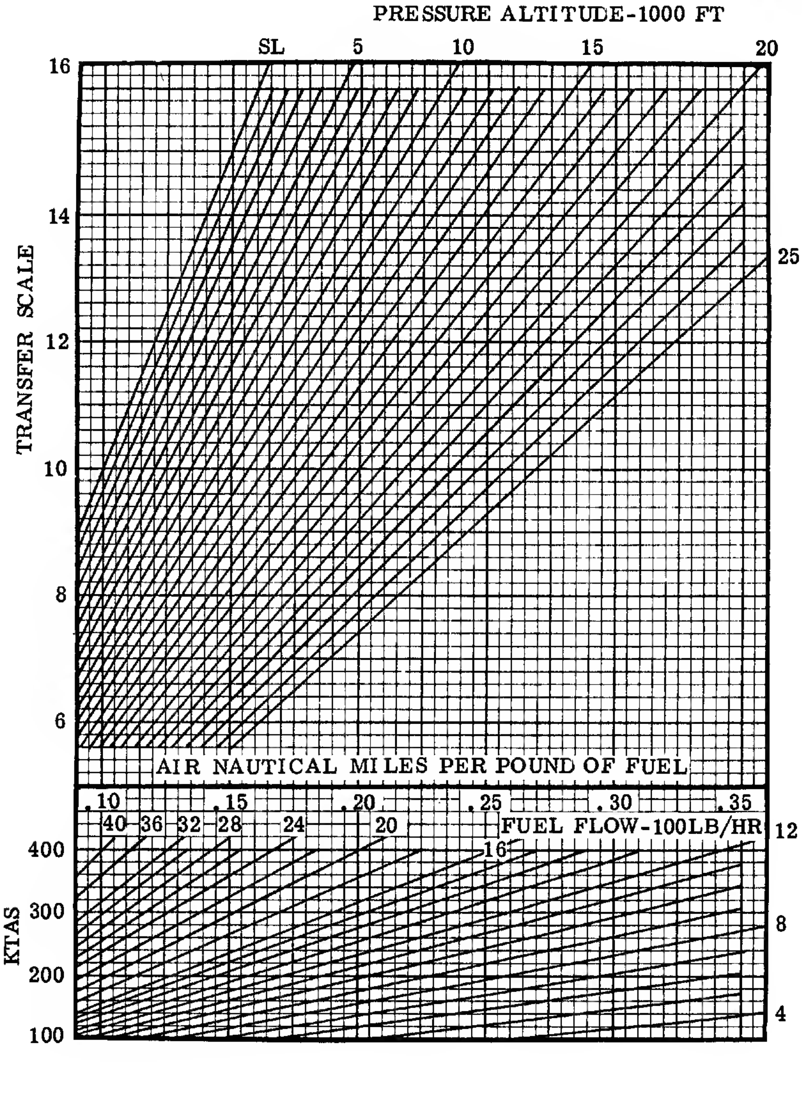


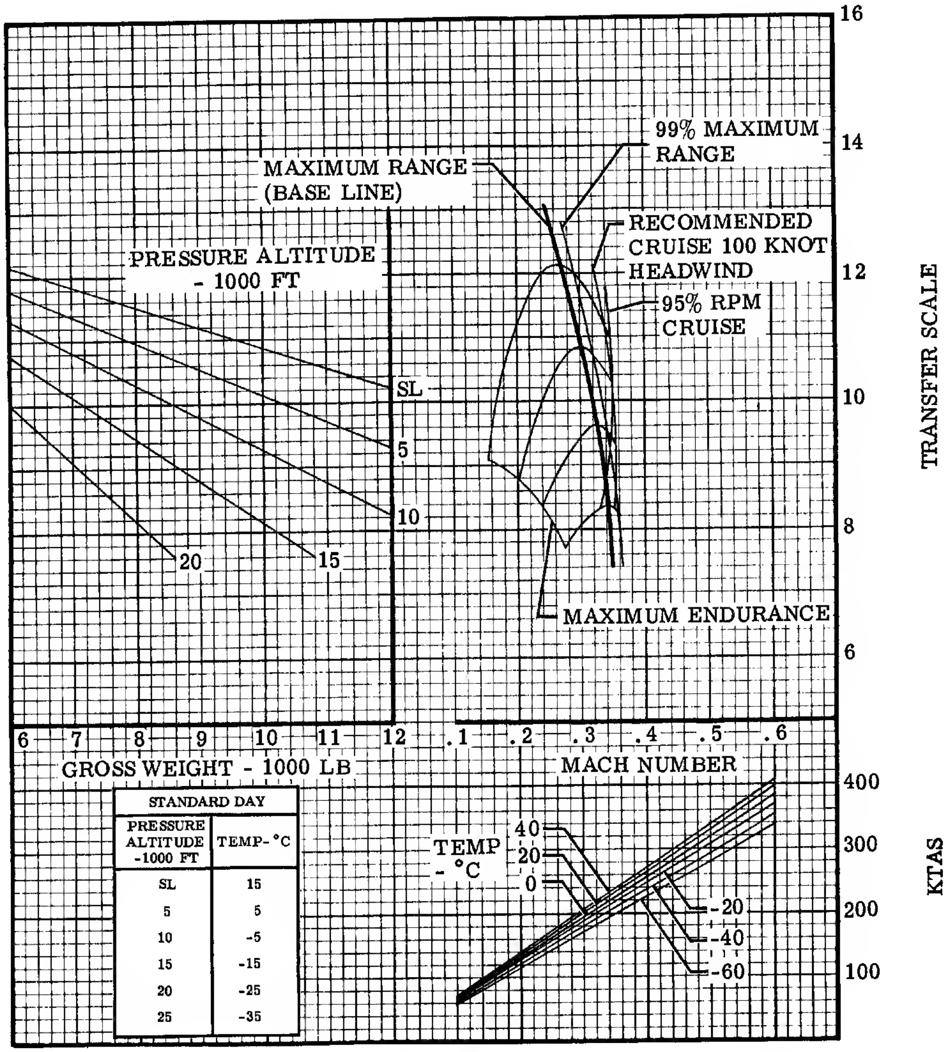
Figure A4-19 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE
DRAG INDEX 400

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP-°C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-20 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

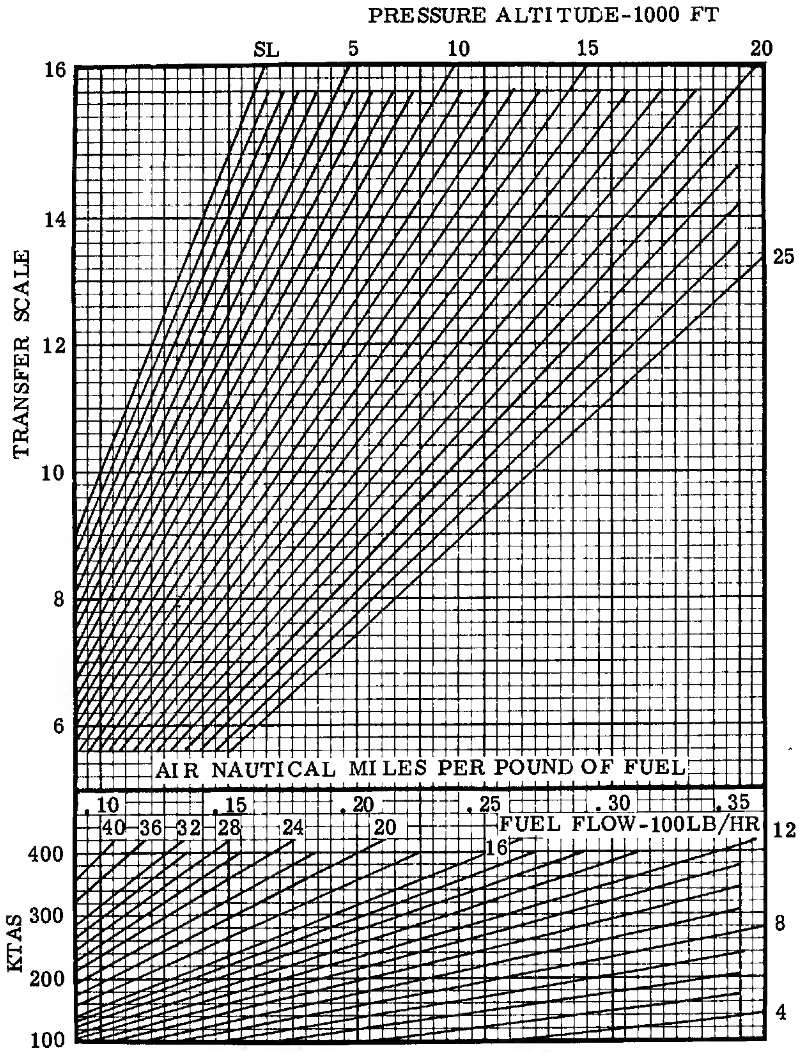


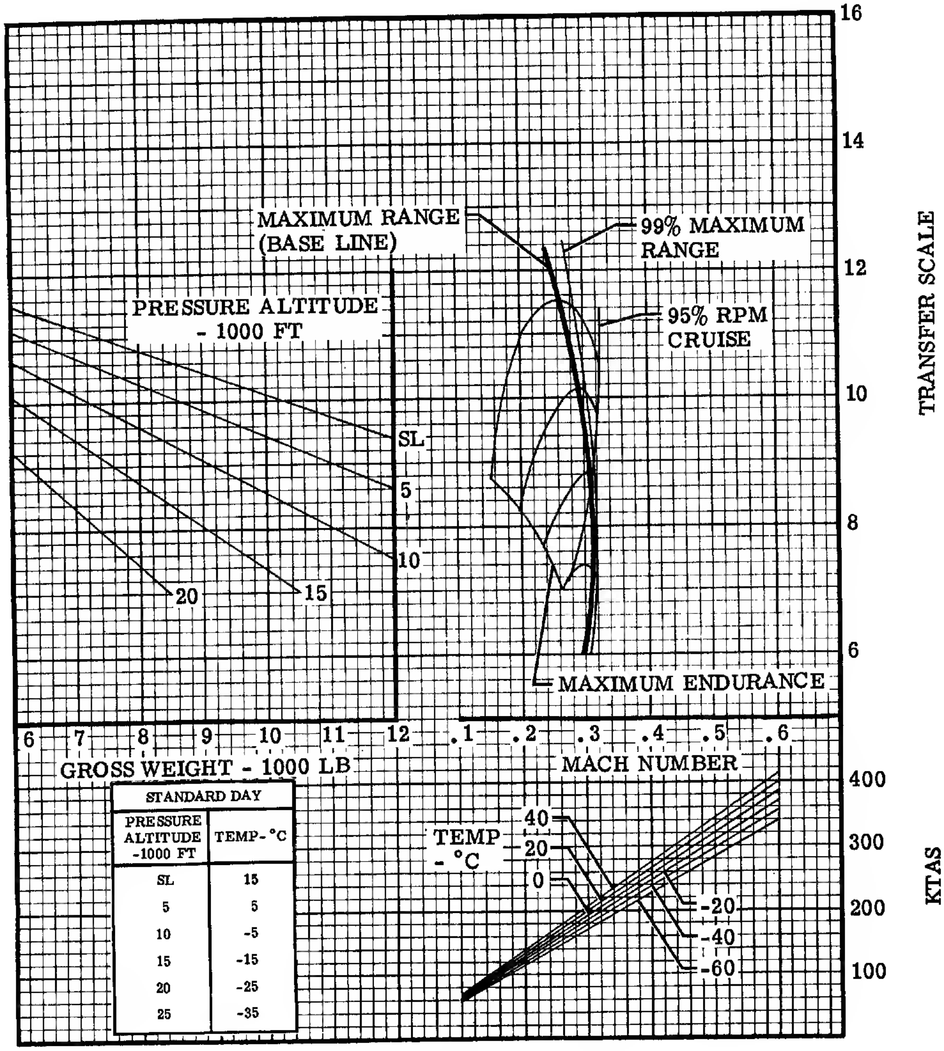
Figure A4-20 (Sheet 2 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE
DRAG INDEX 500

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



STANDARD DAY	
PRESSURE ALTITUDE -1000 FT	TEMP- °C
SL	15
5	5
10	-5
15	-15
20	-25
25	-35

Figure A4-21 (Sheet 1 of 2)

AIR NAUTICAL MILES PER POUND OF FUEL

SINGLE ENGINE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

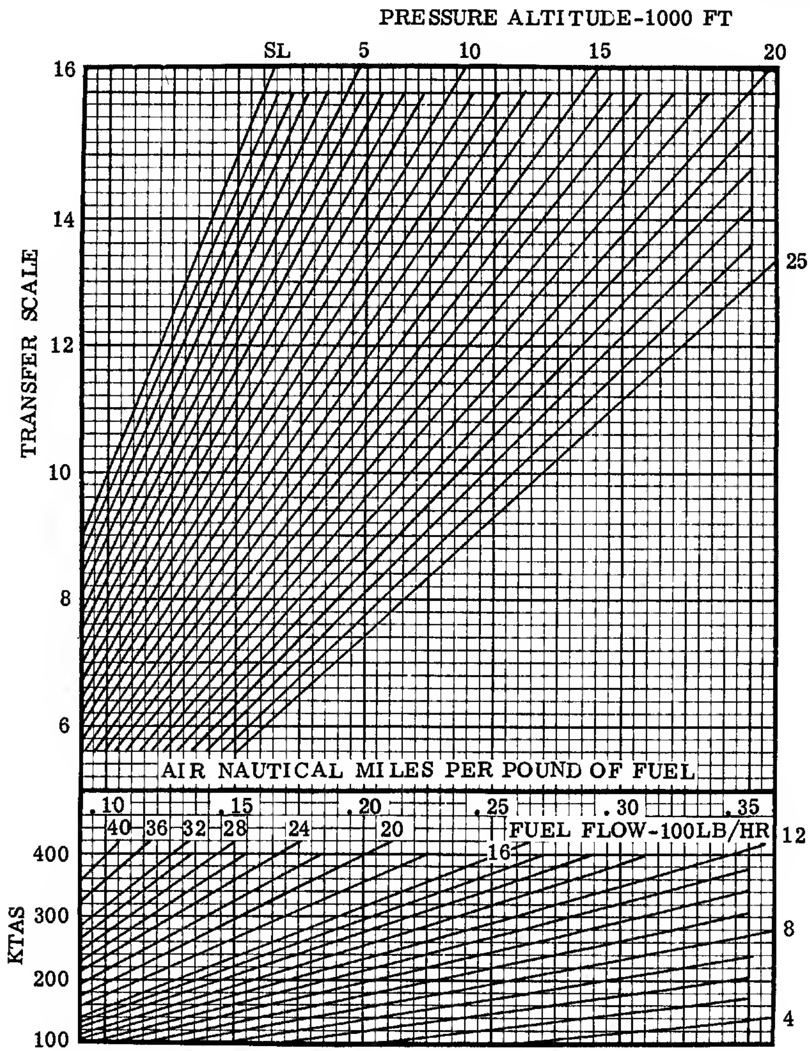


Figure A4-21 (Sheet 2 of 2)

PART V — ENDURANCE

TABLE OF CONTENTS

MAXIMUM ENDURANCE

The Maximum Endurance charts (figure A5-1, A5-2, A5-3 and A5-4 enable the pilot to determine loiter time available for a given fuel quantity, or fuel required for a specified loiter time, at maximum endurance speed, for any given conditions of altitude and gross weight. Charts for both two engine and single engine operation are included.

USE

Loiter time available for a given quantity of fuel is read from the chart at the intersection of a line representing average gross weight and loiter altitude, and a line representing loiter fuel. To find fuel used during a specified loiter time, the chart is entered with an estimated average gross weight, required altitude and time. If the required fuel indicated results in an average gross weight which is appreciably different from the estimated weight, the computation is then reworked using the new gross weight.

EXAMPLE I:

Conditions:

Initial Gross Weight: 11, 000 lb
Loiter Altitude: 25, 000 ft

Find: Loiter time available with 1200 lb fuel.

Solution:

1. Determine Average Gross Weight:
   Initial Gross Weight: 11, 000 lb
   Loiter Fuel: 1200 lb
   Final Gross Weight: 11, 000–1200 = 9800 lb
   Average Gross Weight: $\frac{11,000+9800}{2} = 10,400$ lb

2. Enter figure A5–2:
   At average Gross Weight = 10, 400 lb (A)
   Move horizontally to Altitude = 25, 000 ft (B)
   Construct vertical line (BC)

3. Re-enter Chart at Fuel Used = 1200 lb (D)
   Move up to Drag Index Line = 100 (E)
   Construct horizontal line (EF)

4. At the intersection of constructed lines (BC) and (EF) read Time = 54 minutes (G)

EXAMPLE II:

Conditions:

Initial Gross Weight: 10, 500 lb
Loiter Altitude: 5000 ft

Find: Fuel used to loiter for 1 hour.

Solution:

1. Estimate Fuel Used: 1000 lb

2. Determine Estimated Average Gross Weight:
   Initial Gross Weight: 10, 500 lb
   Estimated Fuel Used: 1000 lb
   Estimated Final Weight: 10, 500-1000 = 9500 lb
   Estimated Average Gross Weight: $\frac{10,500+9500}{2} = 10,000$ lb

3. Enter figure A5-2:
   At Average Gross Weight = 10, 000 lb (H)
   Move horizontally to Altitude = 5000 ft (I)
   Drop vertically to Time = 1 hr (J)
   Move horizontally to Drag Index Line = 100 (K)
   Drop to Fuel Used scale and read
   Fuel Used = 1800 lb (L)

4. Revise Estimated Average Gross Weight:
   Initial Gross Weight: 10, 500 lb
   Computed Fuel Used: 1800 lb
   Final Gross Weight: 10, 500-1800 = 8700 lb
   Average Gross Weight: $\frac{10,500+8700}{2} = 9600$ lb

5. Entering the chart at 9600 lb Average Gross Weight it is evident the solution would be essentially the same as shown above, therefore, the problem is not reworked.

MAXIMUM ENDURANCE - MACH NUMBER

TWO ENGINES

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

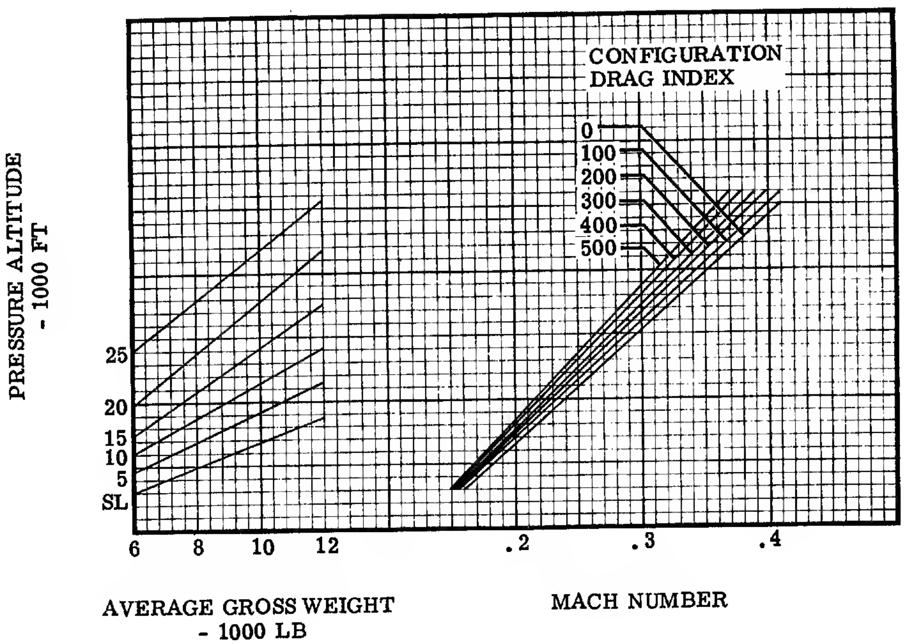


Figure A5-1

MAXIMUM ENDURANCE - FUEL

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

TWO ENGINES

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

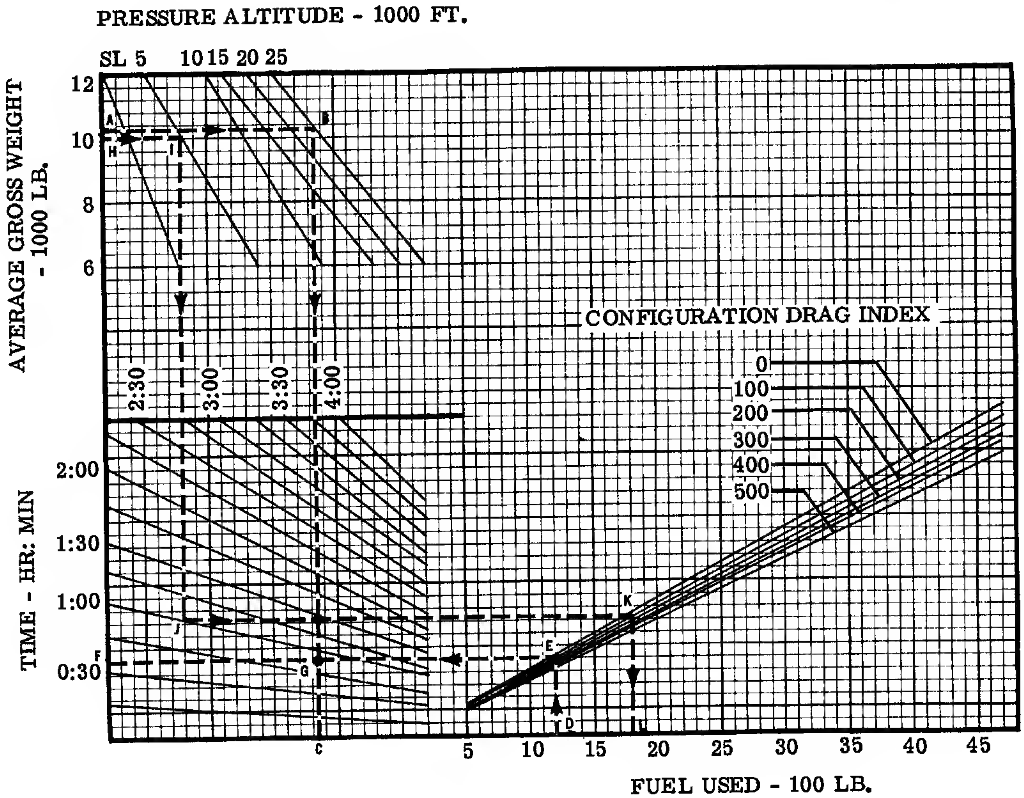


Figure A5-2

MAXIMUM ENDURANCE-MACH NUMBER

SINGLE ENGINE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

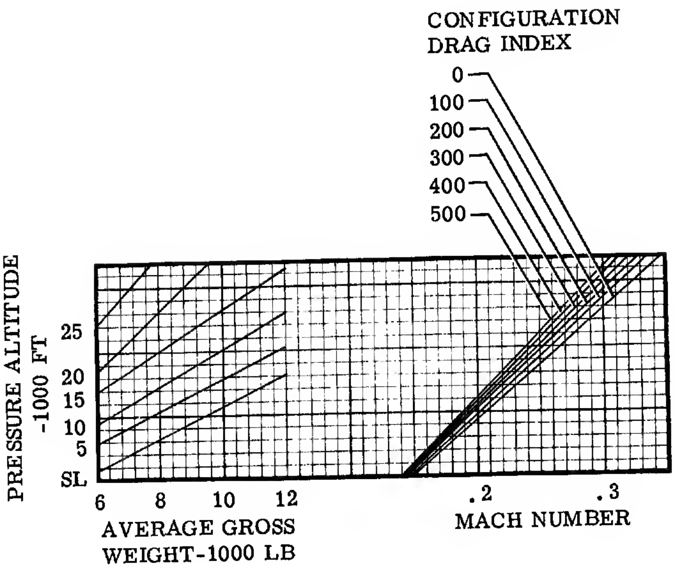


Figure A5-3

MAXIMUM ENDURANCE-FUEL

SINGLE ENGINE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (1) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

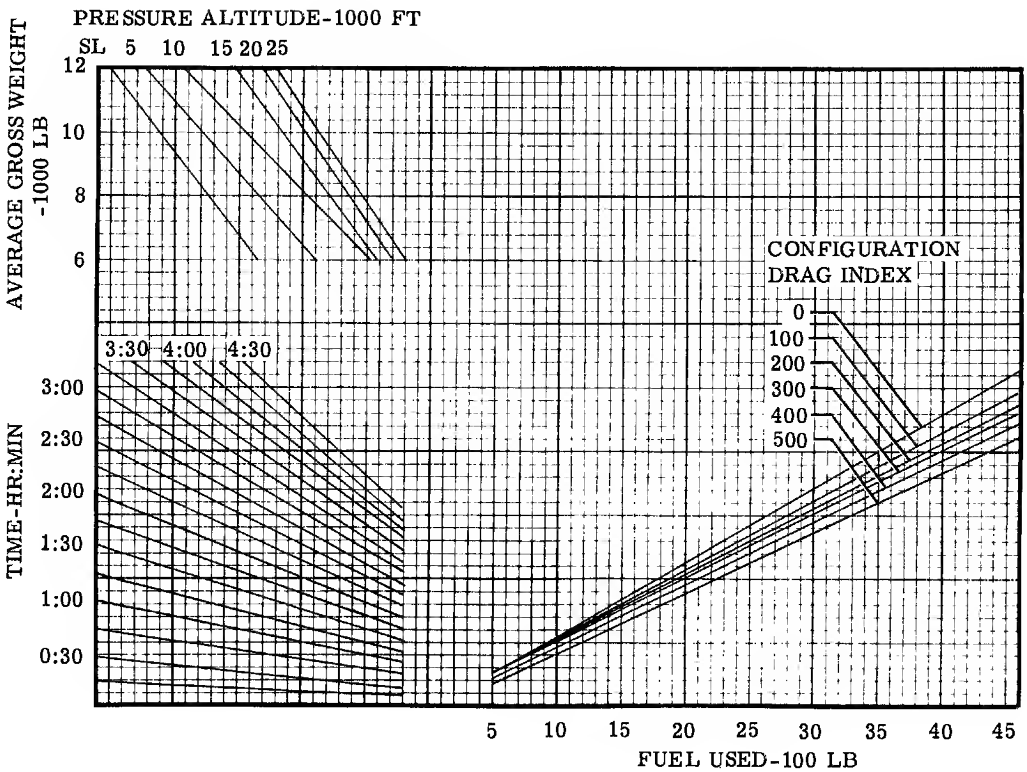


Figure A5-4

PART VI — COMBAT ALLOWANCE

TABLE OF CONTENTS

COMBAT ALLOWANCE

The Combat Allowance Chart shows the relationship between time and fuel with changes in altitude, gross weight, and drag index at 90% thrust. Combat time, fuel used, and fuel flow may be determined from this chart for given altitude, gross weight and drag index.

USE

Combat time available for a given quantity of fuel is read from the chart at the intersection of a line representing average gross weight and combat altitude and a line representing combat fuel. To find fuel used during a specific combat time and Mach number, the chart is entered with an estimated average gross weight, required altitude and time. If the required fuel indicated results in an average gross weight which is appreciably different from the estimated weight, the computation is then reworked using the new gross weight.

EXAMPLE:

Conditions:

Initial Gross Weight	10, 000 lbs
Combat Altitude	2000 ft
Drag Index	150
Combat Time	20 minutes

Find: Combat fuel used and Mach number.

Solution:

1. Enter figure A6-1
   At Gross Weight = 10, 000 lb (A)
   Move horizontally to Altitude = 2000 ft (B)
   Drop vertically to Drag Index line = 150 (C)
   Construct horizontal line = (CE)

2. Re-enter chart at time used = 20 minutes (D)
   Move up to line (CE)

3. At the intersection of constructed lines (CE) and (DE) read fuel used = 1375 lbs

4. Enter the Drag Index, Altitude and Mach number chart.
   At Combat Altitude = 2000 ft (F)
   Move horizontally to Drag Index line = 150 (G)
   Drop vertically to Mach number = .508 MACH

COMBAT ALLOWANCE CHART

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

TWO ENGINES 90% RPM
STANDARD DAY, INLET SCREENS EXTENDED

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

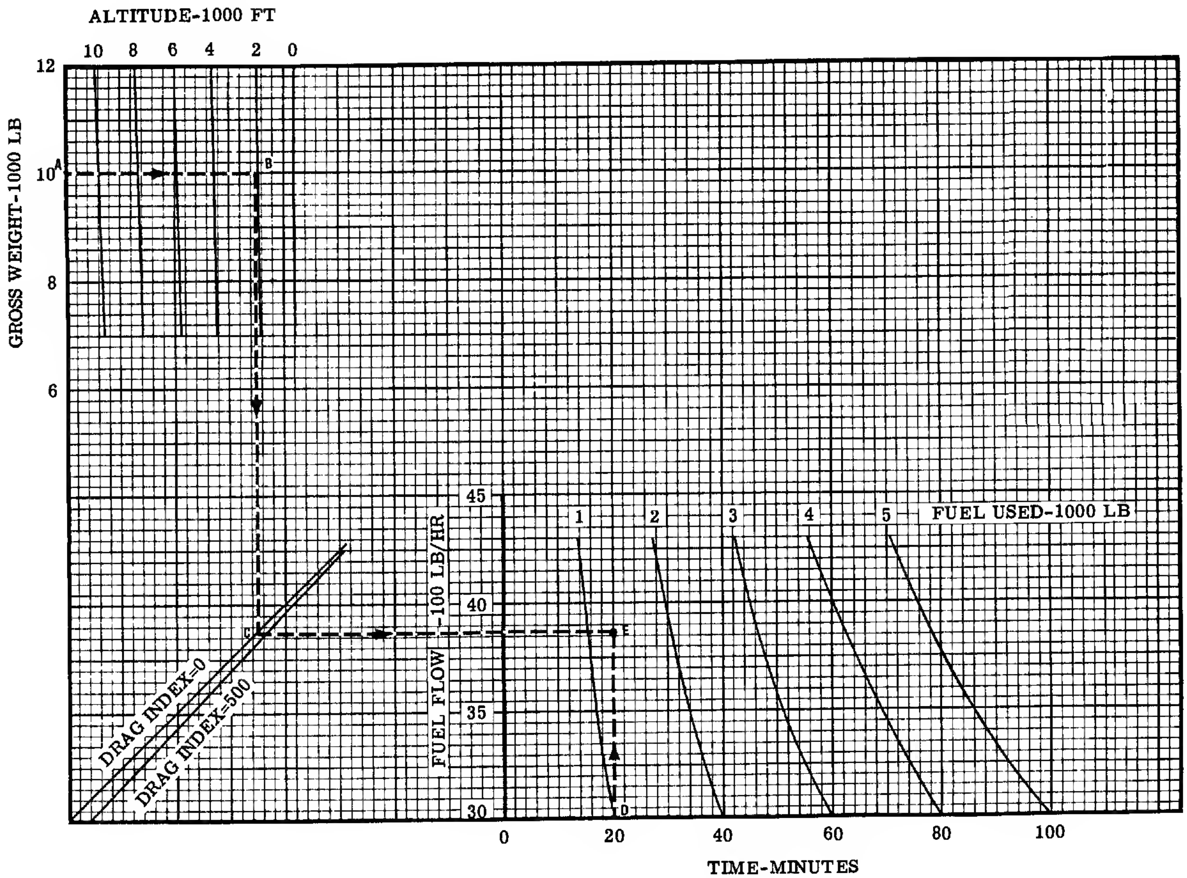


Figure A6-1

PART VII — DESCENT

TABLE OF CONTENTS

DESCENT

Three types of descents are shown in the Descent Charts (figures A7-1, A7-2 and A7-3).

1. The maximum range descent is made with idle rpm, speed brake retracted, recommended descent speed and gross weight for the maximum distance covered.

2. The penetration descent is made with 70% rpm, 250 KCAS, and speed brake extended and should be used during instrument and controlled approaches.

3. The combat descent is made with idle rpm, speed brake extended and limit CAS and should be used only when it is necessary to descend in the minimum possible time.

PROBLEM:

Obtain rate-of-descent, time to descend, horizontal distance traveled and fuel used to descend from 20,000 feet using maximum range descent at an initial gross weight of 9,000 pounds and a drag index of 200.

SOLUTION: (See figure A7-1)

A. Is initial gross weight, 9,000 pounds
B. Is entry altitude, 20,000 feet.
C. Is horizontal distance traveled, 26.3 Naut. Mi.
D. Is drag index line, 200
E. Is time elapsed, 6.4 minutes
F. Is initial gross weight guide line, 9000 pounds
G. Is fuel used guide line, 84 pounds
H. Is drag index, 200
I. Is initial gross weight, 9,000 pounds
J. Is KCAS, 212 knots

PROBLEM:

Using combat descent obtain rate-of-descent, horizontal distance traveled, and fuel used to descend from 25,000 feet at an initial gross weight of 10,000 pounds and a drag index of 200.

SOLUTION: (See figure A7-3)

A. Is initial gross weight, 10,000 pounds
B. Is entry altitude, 25,000 feet
C. Is Drag Index, 200
D. Is distance covered in descent, 7.7 Naut. Mi.
E. Is time elapsed guide line intersection
F. Is time elapsed in descent, 1.29 minutes
G. Is fuel used guide line intersection
H. Is fuel used in descent, 15.5 pounds

MAXIMUM RANGE DESCENT

IDLE

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

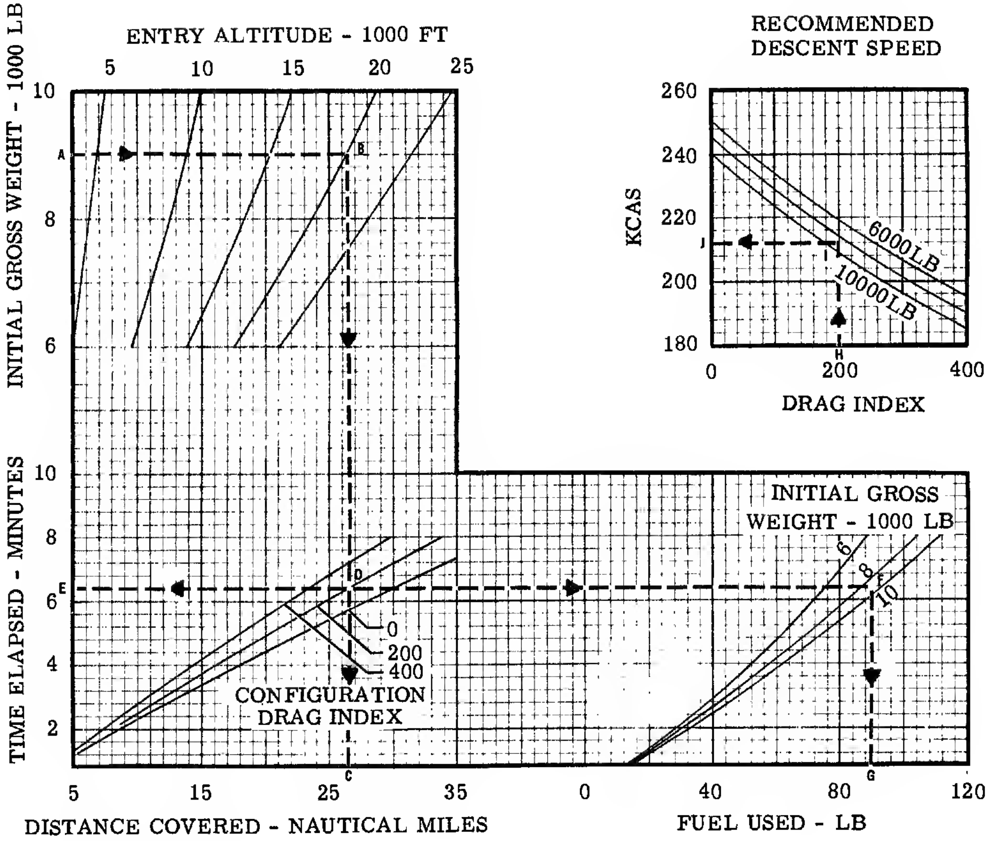


Figure A7-1

PENETRATION DESCENT

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated.

70% RPM
250 KIAS
SPEED BRAKE EXTENDED

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

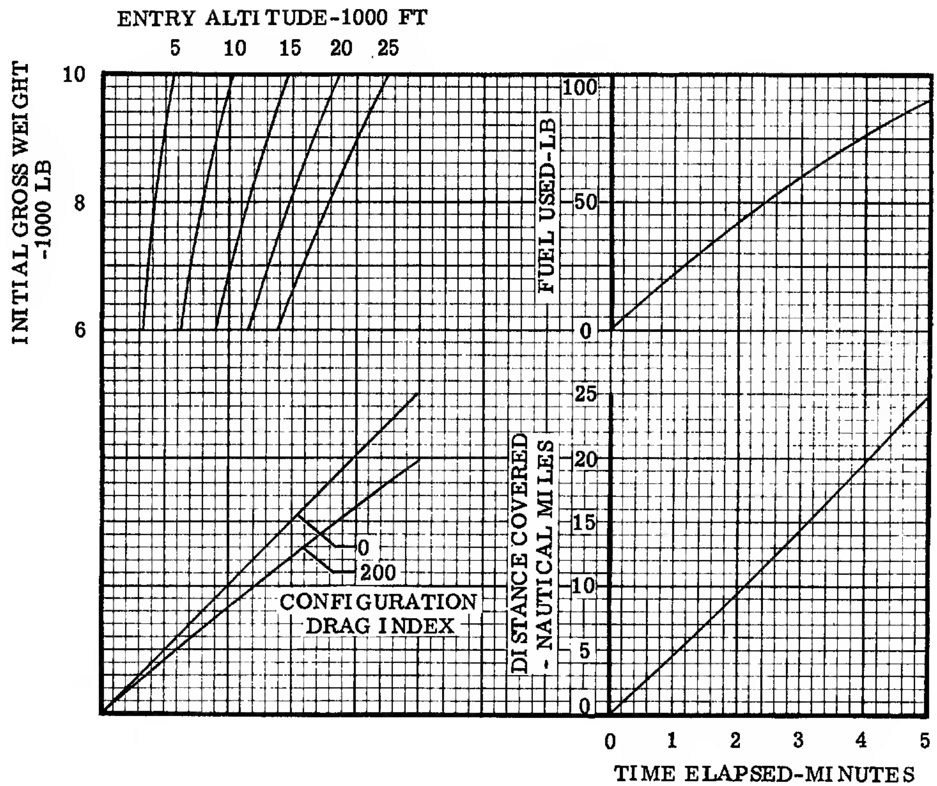


Figure A7-2

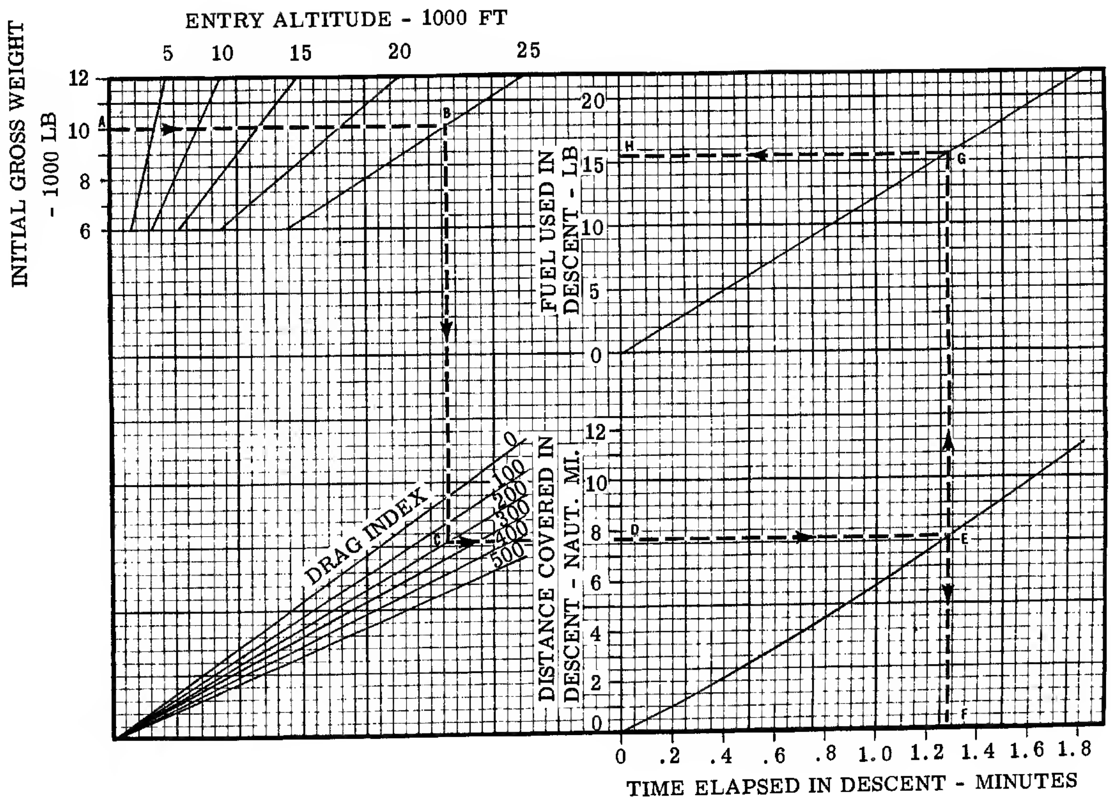
COMBAT DESCENT

IDLE

SPEED BRAKE EXTENDED

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal



NOTE:
RECOMMENDED SPEED IS LIMIT
MACH NUMBER (0.7M) LESS 30 KCAS

Figure A7-3

TABLE OF CONTENTS

LANDING SPEEDS

The Landing Speed Chart (figure A8-1) gives the speed over a 50 foot obstacle and at touchdown, as a function of gross weight. The recommended normal approach speed for all gross weights is 110 KIAS with 100% flaps and 120 KIAS with zero flaps.

NORMAL LANDING DISTANCE

The Normal Landing Distance Chart (figure A8-2) is used to determine the distance required to clear a 50-foot obstacle, touchdown and come to a complete stop. The chart assumes a normal approach speed of 110 KIAS, 100% flaps, speed brake extended, idle rpm below 50 feet, and normal braking during the ground roll. The distance required for flaps up landings may be found by adding 20% to the distance with 100% flaps. The ground roll is increased by 75% when landing on wet, slippery runway.

The normal landing distance may be reduced by 30% by approaching with the minimum approach speed (see figure A8-1); however, this is only recommended when the available runway length will not permit the use of 110 KIAS approach speed.

SAMPLE PROBLEM:

A landing is to be made on a dry, hard runway at 2000 feet pressure altitude. The temperature is 28°C (82°F) and the headwind component is 10 knots. A normal approach at 110 knots with 100% flaps is to be used. The aircraft gross weight is 7000 lbs.

SOLUTION: (See figure A8-2)

A. Is temperature 26°C (82°F)
B. Is pressure altitude (2000 feet)
C. Is gross weight (7000 lbs)
D. Is wind base line
E. Is headwind component (10 Knots)
F. Is ground roll (1000 feet)
G. Is total distance line intersection guide line
H. Is total distance over 50 foot obstacle to stopping point (2700 feet)

CORRECTION TO LANDING GROUND ROLL FOR RUNWAY CONDITION READING

When other than dry conditions exist on active runways, base operation officers are responsible for determining and relaying to the base weather station the type of runway covering and the relative slickness of the runway, as determined by the James brake decelerometer. This information will be transmitted as part of the teletype weather sequence. The relative slickness of the runway is determined as outlined in T.O. 33-1-23. This number will either be a one or two digit number and is referred to as the runway condition reading. This number will be followed by the letter "P" if the runway is patchy. A report of SLR14P would indicate slush on the runway, RCR of 14, and patchy conditions. Explanation of terms is as follows:

RCR -- Runway condition reading
P -- Patchy
WR -- Wet runway
SLR -- Slush on runway
LSR -- Loose snow on runway
PSR -- Packed snow on runway
IR -- Ice on runway

The ground roll distances given in figure A8-2 are for an RCR of 23, which represents a normal dry hard surface runway. The corrected ground roll for an RCR less than 23 may be found from figure A8-3 using the dry runway distance and the latest reported RCR for the destination runway. To determine the corrected total distance over a 50 foot obstacle, first subtract the dry runway ground roll from the total distance shown in figure A8-2 to find the air distance, then add the corrected ground roll. If the reported RCR is equal to or greater than 23 use the distances shown directly in the Normal Landing Distance chart without any further corrections.

Note

If no RCR is available, use 12 for wet runways and 5 for icy runways.

SAMPLE PROBLEM:

From the previous sample problem, the dry runway ground roll was 1000 feet and total distance was 2700 feet. Find the ground roll and total distance if the latest reported RCR = 12.

SOLUTION: (See figure A8-3)

A. Is dry runway ground roll (1000 feet)
B. Is RCR = 12
C. Is corrected ground roll (1800 feet)

Determine corrected total distance:

Dry runway total distance:	2700 ft
Dry runway ground roll:	1000 ft
Air distance	2700-1000 = 1700 ft
Corrected ground roll:	1800 ft
Corrected total distance:	1700+1800 = 3500 ft

LANDING SPEED

ALL CONFIGURATIONS
SPEED BRAKE EXTENDED
100 % FLAPS

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

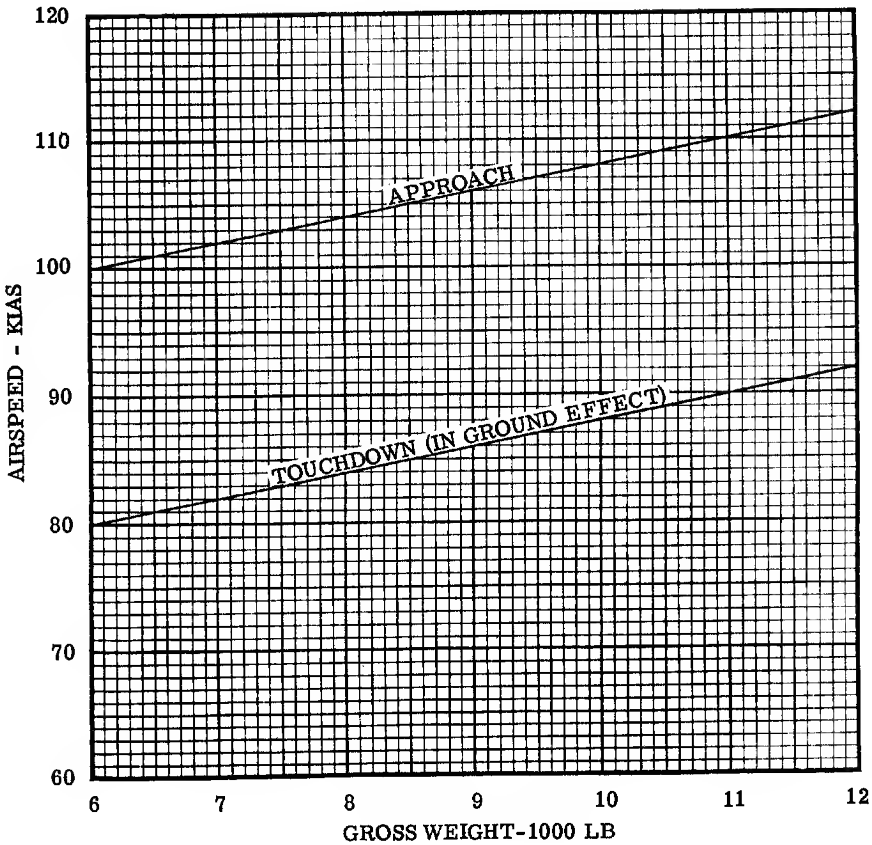


Figure A8-1

NORMAL LANDING DISTANCE

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

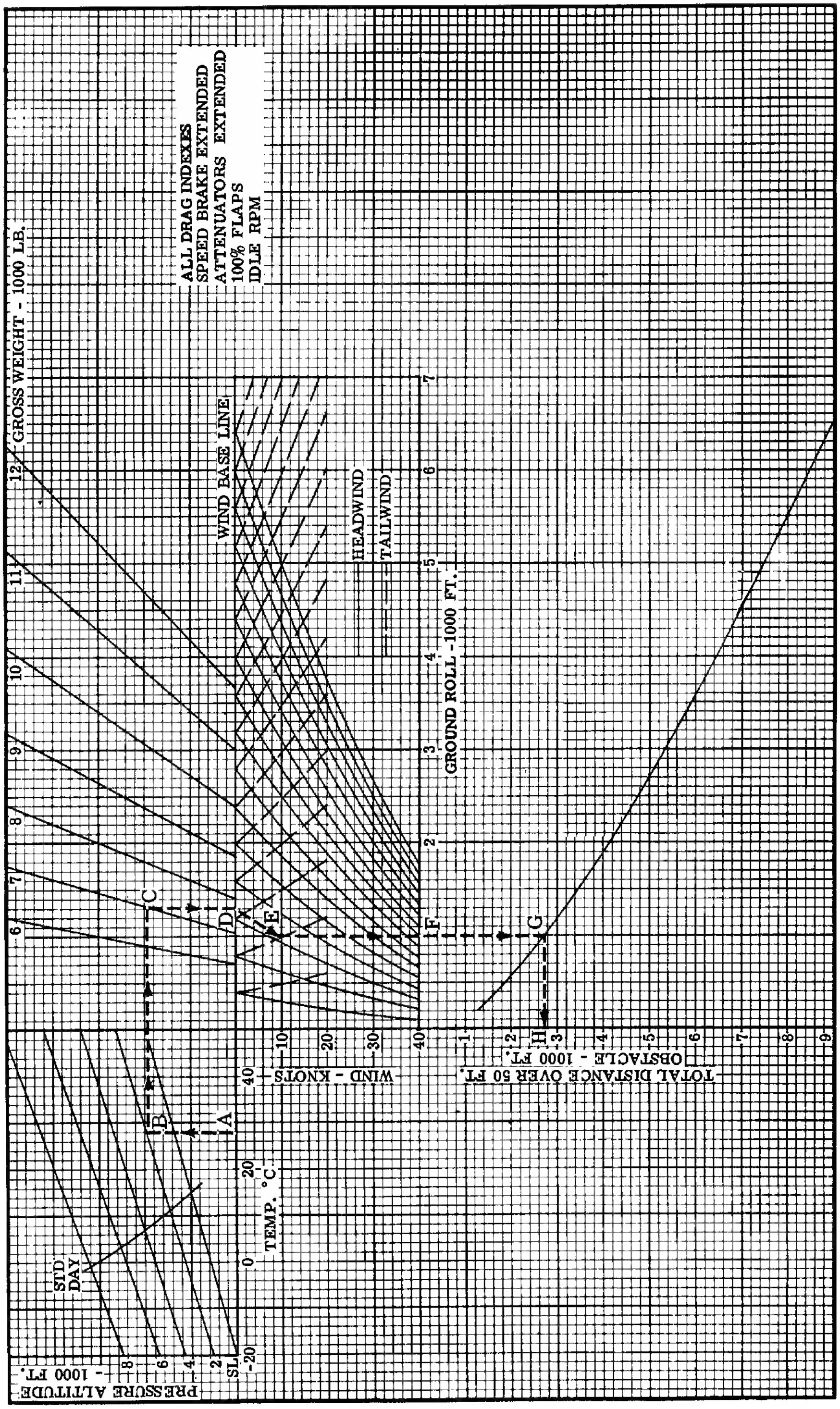


Figure A8-2

CORRECTION TO LANDING GROUND ROLL FOR RUNWAY CONDITION READING (RCR)

Model: A-37A
Date: 1 Feb. 1967
Data Basis: Estimated

STANDARD DAY
Engines: (2) J85-17A
Fuel Grade JP-4
Fuel Density 6.5 Lbs/Gal

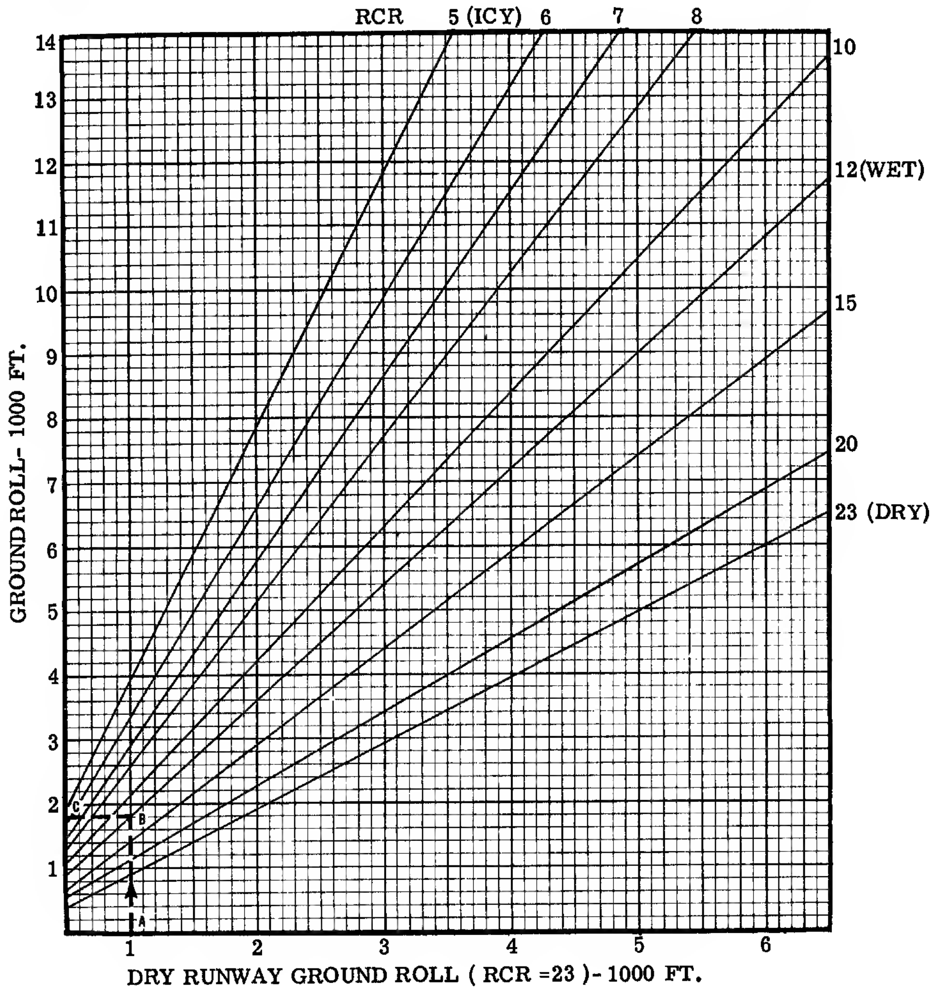


Figure A8-3

PART IX — MISSION PLANNING

TABLE OF CONTENTS

TAKEOFF AND LANDING DATA CARD

The takeoff and landing data card is included in the Flight Crew Checklist. The takeoff and landing information for the planned mission should be entered on the data card and used as a ready reference for review prior to takeoff and landing. A complete sample problem of a mission, to familiarize the pilot with the use of the charts and procedures to fill out the takeoff and landing data card, is shown at the end of this Section.

The takeoff and landing data card definitions are as follows:

CONDITIONS

GROSS WEIGHT

Gross weight of the aircraft at start of mission in pounds.

RUNWAY AIR TEMPERATURE

Runway air temperature in degrees centigrade.

FIELD PRESSURE ALTITUDE

Altimeter reading in feet for dial set at 29. 92 inches of mecury.

EFFECTIVE WIND

Reported wind conditions.

RUNWAY LENGTH

Useable length of runway in feet.

CRITICAL FIELD LENGTH

The distance required to accelerate to critical engine failure speed and either stop or continue to takeoff on single engine.

TAKEOFF DATA

TAKEOFF RUN

The distance required to accelerate to takeoff speed.

TAKEOFF SPEED

The speed at which the aircraft will leave the ground.

REFUSAL SPEED

The refusal speed (KIAS) is the maximum speed at which the aircraft can be stopped in the remaining runway length.

BEST ANGLE OF CLIMB FOR ONE ENGINE

The speed that will result in the maximum angle of climb for single engine conditions (135 KIAS).

LANDING DATA

GROSS WEIGHT

Gross weight of the aircraft at end of mission in pounds.

MINIMUM TOUCHDOWN SPEED

The speed at which the aircraft will contact the runway.

LANDING ROLL

The distance required to decelerate from the touchdown speed to full stop.

SAMPLE PROBLEM

This mission planning problem is included as an additional aid in the application of the data presented in Appendix I. A typical combat mission will be planned in the succeeding paragraphs and each of the charts will be used in the progress of the flight.

For this mission, the following conditions are assumed:

a. The mission is to be a low level strike at a target 230 nautical miles due west of the home field and return. The cruise altitude shall be 25, 000 feet.

b. The weather report over the intended route includes a 25 knot wind from 270° at 25,000 feet. The temperature at 25,000 feet is -44.5°C.

c. The home field conditions are: elevation 500 feet, altimeter setting 29.75 and temperature 27°C, wind southwest at 20 knots, runway 18 which is 6000 feet long is the active runway, RCR = 12 (surface wet).

d. Aircraft loading will include:

Armament	Weight (Fig. A1-7)	Drag index (Fig. A1-7)
(2) MK 82 Bombs	1062 lb.	14
(2) LAU-32/A Rocket Launchers	350 lb.	12
Nose Gun Ammunition	69 lb.	0
Total	1481 lb.	26
Fuel		
Fuel Internal	1885	0
Tip Tanks	1170	0
Drop Tank (2 tanks)	1300	52
Total	4355	52

Gross weight will be 12000 pounds. Drag index fully loaded will be 78 (26 + 52), after the first tank is dropped 52 (78 - 26) and after the second tank is dropped 26 (52 - 26). The drop tanks weigh 85 pounds each when empty (Fig. A1-7).

PLANNING THE MISSION

The first step is to fill out the takeoff and landing data card contained in T. O. 1A-37A-1CL-1.

Conditions

a. Gross weight (Full fuel and crews of two) ..... 12,000 lbs.

b. Runway air temperature (Weather data) .... 27°C

c. Field pressure altitude .... 670 ft.

d. Effective wind
Headwind component (From figure A2-1) .... 14 kts.
Crosswind component (From figure A2-1) .... 14 kts.

e. Runway slope .... 0%.

It must also be noted from figure A2-1 that the minimum nose wheel liftoff and touchdown speed is 76 KIAS.

f. Runway condition reading (RCR) 12

g. Runway length .... 6000 ft.

TAKEOFF DATA

a. Critical field length (From figure A2-4) .... 2470 ft.

b. Takeoff run (From figure A2-3) .... 1260 ft.

c. Takeoff speed (From figure A2-2) .... 94 KIAS

d. Refusal speed (From figure A2-5) .... 96 KIAS

e. One engine out, best speed (From figure A3-4) .... 185 KCAS

LANDING IMMEDIATELY AFTER TAKEOFF

a. Gross weight .... 12,000 lbs.

b. Touchdown speed (From figure A8-1) .... 92 KIAS

c. Landing roll (From figure A8-2) .... 3100 ft.

d. Landing Roll corrected for RCR (From figure A8-2) .... 5580 ft.

LANDING DATA

In order to determine the landing gross weight, complete the airborne portion of the mission at this point and add landing data as the last step.

a. Gross weight .... 6871 lb.

b. Touchdown speed (From Figure A8-1) .... 82 KIAS

c. Landing roll (From Figure A8-2) .... 840 ft.

d. Landing roll corrected for RCR (From Figure A8-3) .... 1520 ft.

A-37A TAKEOFF AND LANDING DATA CARD

CONDITIONS

	TAKEOFF	LANDING
Runway Air Temperature	27°C	27°C
Field Pressure Altitude	670 ft.	670 ft.
Wind (Dir & Vel)	SW 14 kn.	SW 14 kn.
Runway Condition Reading (RCR)	12	12

Runway Length	6000 ft.	6000 ft.

TAKEOFF

Gross Weight	12, 000 lbs.	6871 lbs.
Takeoff Run	1260 ft.	
Takeoff Speed	94 KIAS	
Refusal Speed	96 KIAS	
Critical Field Length	1900 ft.	
Best Climb for one Engine (clean)	185 KCAS	

LANDING

	IMMEDIATELY AFTER TAKEOFF	FINAL LANDING
Gross Weight	12, 000 lbs.	6871 lbs
Touchdown Speed	92 KIAS	82 KIAS
Landing Roll	5580 ft.	1520 ft.

It is assumed that the initial wind conditions still prevail and it can be seen from figure A2-1 the minimum touchdown speed cannot be less than 76 KIAS.

THE AIRBORNE PORTION OF THE MISSION IS PLANNED AS FOLLOWS:

OUTBOUND LEG

The outbound leg consists of a climb from field elevation to cruise altitude and then cruise at speeds for 99% maximum range to the target. Drop wing pylon tanks when empty.

a. Climb from 500 to 25, 000 feet

1. Gross weight at start of climb (allow 300 pounds for ground operation and takeoff)
(Engine start gross weight - ground allowance = 12, 000 - 300).... 11, 700 lb.

2. Fuel used
(Figure A3-2)................. 365 lb.

3. Time required
(Figure A3-3)................6. 5 min.

4. Horizontal distance covered
(Figure A3-3)...........25 Natu. Mi.

b. Drop empty wing tank.

c. Cruise at 25, 000 feet

1. Intial cruise gross weight
(Engine start gross weight - ground allowance - climb fuel - drop tank = 12, 000 - 300 - 365 - 85)..... 11, 250 lb.

2. Fuel used
(Fuel left in second drop tank)... 635 lb.

3. Distance
(Specific range at DI = 52 from Figure A4-2 multiplied by fuel used)............125 Naut, Mi.

4. Time required
(Figure A4-3)...............26. 6 min.

d. Drop empty wing tank.

e. Cruise at 25, 000 feet

1. Initial cruise gross weight
(Engine start gross weight - ground allowance - climb fuel - drop tank - fuel used from second drop tank - drop tank = 12, 000 - 300 - 365 - 85 - 635 - 85).............. 10, 530 lb.

2. Distance (distance covered in descent must be found first)
(mission radius - climb distance - combat descent distance = 230 - 25 - 125 - 9) ....71 Naut. Mi.

3. Fuel used
(Figure A4-2)................. 344 lb.

4. Time required
(Figure A4-3)...............14. 9 min.

ON TARGET

Activity in the target area includes 30 minutes loiter at 25, 000 feet on two engines, a combat descent to sea level and five minutes combat at which time the bombs and rockets are released and the ammunition is discharged.

a. Loiter on two engines at 25, 000 feet at maximum endurance speed.

1. Estimate average gross weight
(weight at end of cruise averaged with weight at end of loiter = $\frac{10186 + 9586}{2}$)...............9886 lb.

2. Time required .... 30 min.

3. Fuel used
(Figure A5-2)................. 595 lb.

4. Actual average gross weight
($\frac{10186 + 9591}{2}$)................9888 lb.

b. Combat descent to sea level
   1. Intial gross weight at descent (weight at step a. 1 - loiter fuel = 10186 - 595) .... 9591 lb.

   2. Fuel used (Figure A7-3) .... 18 lb.

   3. Distance (Figure A7-3) .... 9 Naut. Mi.

   4. Time required (Figure A7-3) .... 1.5 min.

c. Combat at sea level
   1. Time required .... 5 min.

   2. Estimate average gross weight (weight at end of descent averaged with weight at end of combat = $\frac{9573 + 9223}{2}$) .... 9398 lb.

   3. Fuel used (Figure A6-1) .... 338 lb.

   4. Actual average gross weight ($\frac{9573 + 9235}{2}$) .... 9404 lb.

d. Drop bombs and rockets (1412 lb.) and discharge ammunition (69 lb.).

RETURN LEG

The return leg consists of a climb on course, cruise at speeds for 99% maximum range, and then a maximum range descent to field elevation.

a. Climb to 25,000 feet
   1. Initial cruise gross weight ..... 7754 lb.

   2. Fuel used (Figure A3-2) .... 208 lb.

   3. Distance (Figure A3-3) .... 14 Naut. Mi.

   4. Time required (Figure A3-3) .... 3.4 min.

b. Cruise at 25,000 feet on one engine
   1. Initial cruise weight (weight at climb - climb fuel = 7754 - 208) .... 9535 lb.

   2. Distance (Descent distance must first be found) (Mission radius - climb distance - descent distance = 230 - 14 - 24) .... 192 Naut. Mi.

   3. Fuel used (Figure A4-2) .... 606 lb.

   4. Time required (Figure A4-3) .... 41.2 min.

c. Descent to 500 feet
   1. Initial gross weight (Initial cruise weight - cruise fuel = 7546 - 606) .... 6940 lb.

   2. Fuel used (Figure A7-1) .... 69 lb.

   3. Distance covered (Figure A7-1) .... 24 Naut. Mi.

   4. Time elapsed (Figure A7-1) .... 5.3 min.

AT DESTINATION

a. Time elapsed .... 2 hr. 14 min.

   1. Outbound leg (Climb and cruise on drop tank + cruise to target + descent = 6.5 + 26.6 + 14.9 + 1.5) ..... 49.5 min.

   2. On target (Loiter + combat = 30 + 5) .... 35 min.

   3. Return leg (Climb + cruise + descent = 3.4 + 41.2 + 5.3) .... 49.9 min.

b. Total fuel used .... 3478 lb.

   1. Outbound leg (Ground allowance + cruise on drop tank + cruise to target + descent = 300 + 365 + 344 + 18) .... 1662 lb.

   2. On target (Loiter + combat = 595 + 338) ... 933 lb.

   3. Return leg (Climb + cruise + descent = 208 + 606 + 69) .... 883 lb.

c. Fuel Reserve (Initial fuel - total fuel used = 4355 - 3478) .... 877 lb.

d. Landing gross weight (Engine start gross weight - total fuel used - drop tanks - total armament = 12,000 - 3478 - 170 - 1481) .... 6871 lb.

The landing data for 6871 lb. gross weight may now be entered on the Takeoff and Landing Data Card.

SUMMARY

Check your flight plan during the actual flight to determine shatever deviations exist. These deviations may be applied to the reserve expected at the destination. The most important factors to consider are:

Fuel used during start, taxi and takeoff (example was based on 175 pounds for this phase).

Devistion from recommended climb schedule.

Deviation from recommended cruise control.

Variation in engine performance.

Navigational errors, formation flight.

INDEX

ALPHABETICAL

Numbers in Parentheses ( ) Are Illustration Figure Numbers

Numbers in Parentheses ( ) Are Illustration Figure Numbers

D

E

Numbers in Parentheses ( ) Are Illustration Figure Numbers

Numbers in Parentheses ( ) Are Illustration Figure Numbers

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